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*The Phylogeny and Classification*  
*of the North American Genera*  
*of the*  
Suborder Tubulifera (Thysanoptera)

LEWIS J. STANNARD, JR.

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ILLINOIS BIOLOGICAL MONOGRAPHS: *Number 25*

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THE PHYLOGENY AND CLASSIFICATION OF THE NORTH AMERICAN  
GENERA OF THE SUBORDER TUBULIFERA (THYSANOPTERA)





*The Phylogeny and Classification*  
*of the North American Genera*  
*of the*  
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Although indebted to all mentioned herein, I am obligated in particular to Professor H. H. Ross. I single out Professor Ross because he taught me the fundamentals of taxonomy and willingly gave of his time and thoughts to hear my many problems on nomenclature, morphology, and the puzzling problems of variation in the thrips. I am most grateful for his encouragement and guidance.

L. J. S., JR.



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## Introduction

The Thysanoptera or thrips as an order are the smallest of the pterygote insects. Possibly because of their minuteness only a limited number of students have ever attempted serious studies of them. In North America particularly, there have never been more than a half-dozen thysanopterists actively working at any one time since Fitch described the first American species in 1855.

It is not surprising then to find that, as Hood wrote in 1912, "The classification of the order Thysanoptera is admittedly much in need of attention and reliable synopses of genera and species are conspicuously wanting." Today, more than 40 years later, the same long-felt need for synopses still exists, especially of the North American fauna.

In the earlier days of thrips investigations several monographs were presented. Uzel's monograph of 1895 became the basis for our modern studies. Shortly after Uzel laid the groundwork, Hinds treated the North American species in 1902. Stimulated by both of these volumes, a number of students took up the study of Thysanoptera; most of them began their work during the decade between 1908 and 1918. It was these thysanopterists, notably Bagnall, Hood, Karny, Moulton, Priesner, and Watson, who diligently described the species, discovered the main diagnostic features, and devised our system of classification. Other capable workers joined in from time to time, and during the last half century, they and the older students have contributed a plethora of new species and generic descriptions which have appeared in many of the scientific journals of the world.

Amidst such a welter of new species and genera, it was indeed a bright note when, in 1949, Priesner published a key to the known genera. Now that a key is available, efforts could profitably be directed toward analytical studies of the groups and even detailed studies of species much as Speyer, Ghabn, and Pelikán have done. In far too many instances, however, our keys and descriptions have remained isolated bits of information with little reference to the whole.

In recent years, Priesner and Bailey have revised several groups of large size. Although Priesner's works are by far the most comprehensive in treatment and in scope in comparison to any other student's, past or present, most of his studies pertain to exotic faunas, particularly the European, African, and Oriental faunas.

In this country, Bailey has started to monograph the North American species. Shortly he will have completed reviews of the genera in the family Aeolothripidae of the suborder Terebrantia. There remain, however, many hundred more genera in the other families of the Terebrantia and in the other suborder, the Tubulifera, whose classification needs to be revised.

In particular, the North American Tubulifera are exceptionally poorly understood. Many species have been assigned to the wrong genus and many genera have been erected without redefinition of the older genera from which they were separated. Furthermore, no recent list of these Tubulifera or even the briefest kind of a catalogue or monograph has been available to serve the needs of students of North American thrips.

Because of the lack of synoptic information on them, I have considered it necessary to make a preliminary analysis of the North American Tubulifera at the generic level before delving further into the species problems. Herein is presented the results of my analysis. It is a revision of their classification as based on my interpretations of their phylogeny and includes a list of the species known to be or supposed to be members of the genera involved. The types of the new species are deposited in the collections of the Illinois Natural History Survey.

The North American fauna is meant to include all those populations of Tubulifera occurring from the Arctic Ocean to Panama, on both the mainland and the islands. Central America, bounded on the north by the Isthmus of Tehuantepec and on the south by the Isthmus of Panama, is considered here as a part of North America proper.

The order Thysanoptera is divided into two suborders. One suborder, the Terebrantia, is composed of species in which the females have saw-like ovipositors. The other suborder, the Tubulifera, is composed of species in which the females lack ovipositors. For purposes of orientation, the differences and similarities between the two suborders are outlined in Table 1.

The Tubulifera contain but a single family of Thysanoptera, the family Phlaeothripidae. Because they apply to the same thrips, the names Tubulifera and Phlaeothripidae are used in this report interchangeably. In the past, many other families and even another suborder were erected for the species of this group. For example, Hood (1915c) divided the Tubulifera into two superfamilies containing six families. Eventually more families were added. Recently Priesner (1949) demoted these families, placing some as subfamilies or reducing them to tribal rank. Even at best, these subdivisions, whether they be elevated to families or reduced to lower taxa, are difficult to define. Their extreme representatives may be recognized easily but many of their lesser developed genera intergrade into genera in other subdivisions. Until more satisfactory

TABLE 1. A COMPARISON OF THE SUBORDERS OF THYSANOPTERA

	TEREBRANTIA	TUBULIFERA
Antenna	basically 9- or 8-segmented	basically 8-segmented
Sense cones of antennal segment III	circular, linear, bifid, conical, or seta-like	seta-like
Maxillary stylets	not retracted much into the head	not retracted much into the head to greatly retracted into the head
Maxillary palps	basically 3- to 2-segmented	always 2-segmented
Praepectus	absent	absent or present
Mesopraesternum	absent	absent or present
Mesospinasternum	separate or fused to metasternum	always fused to metasternum
Tarsus	each 2- or 1-segmented; never both conditions in the same species	fore pair always 1-segmented, mid and hind pairs 2- or 1-segmented
Wings (when fully developed)	parallel at rest	crossed at rest
Wing fringe cilia	straight or wavy	always straight
Abdominal segment I	without pelta	with or without pelta
Pleural plates of abdomen	none, one, or two pairs per segment	none
Anal setae	arising directly from tube, i.e., abdominal segment X	arising from sclerites separated from tube
Female	with or without an anal tube; always with sawlike ovipositor, although sometimes degenerate	with anal tube; never with sawlike ovipositor
Male	glandular areas absent, or on few to many abdominal sternites; never with anal tube	glandular areas absent, or present on one to several abdominal sternites; always with anal tube
Pupal instars	one or two	three

definitions can be proposed, I prefer to place all of the species of the Tubulifera within the single family Phlaeothripidae and to group them into two subfamilies, the Phlaeothripinae and the Megathripinae. When feasible, the genera are further arranged into tribes. Otherwise, the genera are placed in phyletic lines which have no nomenclatorial standing. Thus, whenever it is necessary to rearrange genera because of new interpretations of their phylogeny, the matter can be handled without legalistic involvements in the International Rules of Nomenclature. Most importantly, the arrangement of difficult genera in phyletic lines permits tentative groupings for practical use in spite of the imperfections of our knowledge of the Thysanoptera.

## Notes on Habits

The Phlaeothripidae seemingly originated and evolved in the ecological zone that might be called the saprophytic fungus habitat. Wherever spores of these fungi develop, particularly under bark of dead and dying twigs and branches, decaying grasses, or in the molding forest litter, species of the Phlaeothripidae are almost certain to be found. Individuals of a few species characteristically suck juices from mosses and leaves of higher plants, some others ingest juices from bulbs, and still others have become predaceous. By far the majority, however, eat fungus spores.

The members of the many hundreds of species that live under bark or in the leaf mold are flattened dorsoventrally in such a manner that they are well suited to move about in tight places. Those that feed in loosely folded dead leaves or those that are habitually exposed are more rounded in contour. Individuals of two genera, *Preeriella* and *Hydiorhrips*, of unknown habits, are somewhat laterally compressed. Many of the tubuliferous thrips that live free arboreal lives, as well as those that inhabit crevices, prefer darkness to bright light. Rarely do the living-leaf feeders seek the upper surfaces; when forceably placed there they quickly try to return to the side of the leaf that is downward and shaded. They are secretive insects seldom seen by nonspecialists.

Most of the species live in aggregations. Even the predaceous ones occasionally may be found to be numerous within a small area. Eggs, young, and adults may be observed together, yet there does not seem to be any social organization. Perhaps in some of these groups communication may be made by sounds undetectable by the human ear (Hood 1950b).

Individuals with fully developed wings are usually capable of flight although they do not always exercise that ability even when threatened by capture. Most of them seem sluggish, but a few in the tropics can be as quick to leave the beating net as some species of Terebrantia. Apterous individuals when exposed, slowly walk away dragging their abdomens in a serpentine fashion. If disturbed, some of the leaf-feeding and antlike species rear their abdomens (Fig. 3) in much the same manner as staphylinid beetles.

Perhaps in most species of Phlaeothripidae fertilization of the eggs is by means of bisexual union. Cases of unisexual reproduction are more

rare in the Tubulifera than in the Terebrantia (Bailey 1933). In mating the male grasps the female around the pterothorax and mounts her. He then trails his abdomen to one side. When in this position both twist the terminal segments of the abdomen sideways for copulation. Except for a limited number of genera in the Megathripinae, the larvae hatch from deposited eggs. O. John (1923) and others have reported that a few genera related to *Idolothrips* do not lay eggs but give birth to active young. As in all thrips there are only two larval stages in the Phlaeothripidae. These active stages are often brightly colored in various shades of red or purple. Apparently they feed upon the same foods as do the adults.

In those members of the Phlaeothripidae whose life history has been investigated, there are three pupal instars. Presumably no food is taken during these quiescent periods. In the first pupal instar, the antennae and legs are shortened. Wing pads appear in the second pupal instar. Later, in the third pupal instar, the antennae, legs, and wing pads are lengthened. As far as is known, no member of the Phlaeothripidae spins pupal cocoons as do thrips of some species in the Aeolothripidae of the Terebrantia.

Usually there are several generations during the year. In cold climates, all stages may hibernate in the winter. Some stages may aestivate during the dry season in warm climates. With careful searching, adults of many if not the majority of the species may be collected at any time regardless of the season and regardless of the latitude.



# Morphology

The principal morphological treatments of the Thysanoptera have been given by Uzel (1895), Hinds (1902), Peterson (1915), Priesner (1928a), Doeksen (1941), and Pesson (1951). Notwithstanding the fact that these works have been excellent contributions, much remains to be learned of the structures of these tiny insects. In future investigations, particular stress should be given to comparative morphology of the Thysanoptera and the related Corrodentia, Hemiptera, and Homoptera to show the relationships and changes of the sclerites and appendages.

Except when stated otherwise, all parts discussed pertain to adults of the Phlaeothripidae. Whenever possible, the names of the structures are those used by Peterson (1915) and Doeksen (1941).

## HEAD

Peterson's classic work has made the head the best-known body region of the Thysanoptera.

In both the Terebrantia and the Tubulifera, the head is opisthognathus; that is, the mouth parts are directed posteriorly (Fig. 4). When seen from above, the anterior part of the head is bordered by the eyes and a section of the frons. Occasionally the fore ocellus is borne on a protrusion which then may become the anteriormost extension of the head. Also, occasionally that part of the frons that gives rise to the antennae may be extended far forward (Fig. 98). Those portions of the head behind the eyes to its posterior dorsal border are referred to as the cheeks.

*Antennae.* Each antenna is composed of four to nine segments in the recent Thysanoptera. In the representatives of the extant species of the Phlaeothripidae, each antenna is composed of no more than eight segments. Primitively each segment was independently movable, but in individuals of many species the segments are in the process of becoming fused. In these thrips, membranes between certain segments are lacking, although a complete or partial fine suture may still mark the limits of the segments involved (Fig. 8). Many of the segments are narrowed sharply at the base, forming a pedicel; the terminal segments are more apt to lack a pedicel than the intermediate segments.

Sensory organs often occur on all of the segments except the basal one. These organs are not unlike similar structures found in male scale



insects. In the mature individuals of the Phlaeothripidae, the sensorium of the second segment is on the dorsal surface, ordinarily located near the apex. The other sensory organs, found on segments III to VIII, are in the form of elongate cones and may occur singly or in numbers usually around the apex of each segment. These sense cones are often difficult to see or differentiate from the antennal setae. A true sense cone (Fig. 8 *sc*) is generally thicker than a seta, and almost invariably a sense cone has a larger base and is bluntly rounded at the apex whereas a seta has a smaller base and almost always is pointed or dilated at the tip.

*Eyes.* Adults of the Phlaeothripidae possess eyes which extend from the dorsal surface, around the anterior part, to a point on the ventral surface of the head. From the dorsal aspect, the eye may vary in shape from a line of several facets, to a circular mass, or to a form similar to the shape of a bean seed. In some genera, the eyes of the adults are so enlarged that they touch each other on the dorsum at the mesal anterior and posterior angles (Fig. 72). Ventrally the eyes usually occupy space directly below the dorsal eye outline. In a few of the tubuliferous thrips, the ventral extension may be prolonged a considerable distance posteriorly (Fig. 86). Many eye facets are round or oval, but some are hexagonal in shape.

*Ocelli.* True functional ocelli are found only in macropterous or brachypterous adults. Apterous adults, like the larvae and the pupae, lack ocelli. Often in brachypterous forms one or more of the usual three ocelli may be reduced or eliminated entirely. When ocelli occur they are grouped in the form of a triangle, generally between the eyes. Frequently a ring of subintegumental red pigment surrounds each ocellus.

*Setae.* The principal head setae used in taxonomic discussions are the ocellar, the postocular (Fig. 4 *POS*), and the cheek setae. These setae arise from sockets which usually are raised slightly. Infrequently such sockets, particularly those on the cheeks, may be enlarged to resemble warts. Variations of the lengths of these setae, their form at the tip—dilated, blunt, or pointed—and their position provide diagnostic features of taxonomic value.

#### MOUTH PARTS

Although the head of a thrips is opisthognathus, only the basal part of the mouth cone is consistently directed posteriorly. Frequently the apex of the mouth cone is directed downward, yet in some specialized groups the apex or oral opening may be directed backward. Examined from the dorsal aspect, the cleared heads of slide-mounted specimens often show the mouth cones to be broadly rounded. In these cases the oral opening is directed downward. In other cases the mouth cones

appear to be pointed because the oral opening is directed to the rear.

From the ventral view the mouth parts of thrips of both the Terebrantia and the Tubulifera are seen to be asymmetrical (Figs. 6 and 7). Members of no other order of insects have similar asymmetrical or twisted mouth cones. It is the one feature by which all thrips may be recognized immediately.

Unlike the Homoptera and Hemiptera, thrips have well-developed maxillary and labial palps. In all thrips that belong to the Phlaeothripidae, each one of these palps is two-segmented.

*Maxillary stylets.* Unlike the members of the Terebrantia, thrips in the Phlaeothripidae often have the two-segmented stylets (laciniae) borne on maxillary pillars (Fig. 5). Except for representatives of a few genera in this family and in most of the Terebrantia, the stylets retract far into the head when at rest. Primitively the apical part of each stylet is slender but in larvae and adults in the Megathripinae the apical part of the stylet is broadened, being about as broad as the width of the labial palps.

*Maxillary guides.* Most, if not all of the members of the Phlaeothripidae have separate maxillary guides which supposedly guide the stylets (Fig. 5). In those thrips that comprise the Megathripinae, the guides are often degenerate.

#### PROTHORAX

From the dorsal aspect, the pronotum is obliquely cut off at its posterior angles by epimeral sutures (Fig. 76). In some specimens of the Phlaeothripidae these sutures are incomplete and do not attain the posterior margin of the notum (Fig. 59). Occasionally, as in individuals of *Plectrothrips* (Fig. 43), the pronotum is fragmented at the sides into tiny platelets giving the lateral regions the appearance of stippled membrane. The following structures are useful in taxonomic analyses.

*Praepectus.* When present, two plates are secondarily formed in the membrane just anterior to the probasisternum (Fig. 23). These sclerites have been designated as praepectal plates or "breast plates" (Stannard 1950). The praepectus is a structure peculiar to the Phlaeothripidae.

*Probasisternum.* Except in one species (Fig. 25), this part of the thorax is divided into two plates (Fig. 24), and is the principal structure of the prosternum.

*Prospinasternum.* This sternal sclerite is placed directly behind the probasisternum (Figs. 23, 27, and 29). Its size varies; in the thrips of the family Phlaeothripidae it is generally small, whereas in the thrips of the families in the Terebrantia it is a wide collar-like plate.

*Setae.* Around the borders of the pronotum there are several pairs of

major setae which have been used constantly in taxonomic works. These setae are designated as the anteromarginal pair, the anteroangular pair, the midlateral pair, the epimeral setae, and the posteromarginal pair. In most individuals of the Phlaeothripidae the posterior pairs are longer than the anterior ones. The apexes of these setae vary in form; some are pointed, others blunt, and some dilated at the tips.

#### PTEROTHORAX

As in many insects, the mesothorax and the metathorax of thrips are formed into a compact unit, the pterothorax. Among members of a single species, the shape of the pterothorax has been found to vary, depending on the presence or absence of wings. Types of sculpture of the notum may be used taxonomically and the shapes of the sternites offer many useful characteristics for comparative studies.

*Mesopraesternum*. This structure, first designated by Doeksen, lies anterior to the principal sclerite of the mesosternum. Primitively its form is gondola-like (Fig. 29), but in individuals of specialized species the median portion may degenerate and disappear (Figs. 25 and 27). None of the Terebrantia has such a structure.

*Mesospinasternum*. Although often occurring in thrips belonging to the Terebrantia, this sclerite is no longer discernible in any of the Phlaeothripidae. Presumably the phlaeothripoid mesospinasternum has fused to the metasternum.

*Furcae*. The shape and position of these endosternal apodemes in the mesosternum and metasternum afford points for the recognition of some groups. Occasionally the bases of the furcae are extended forward as median ridges on the surface of the sternal sclerites. In certain degenerate thrips the metafurca has moved forward until it nearly touches the mesofurca.

#### LEGS

Often the fore legs are enlarged or especially developed. The mid and hind legs tend to remain generalized in their structure and are seldom enlarged; they rarely have spurs or a reduced number of tarsal segments. In all of the Phlaeothripidae the fore tarsus is composed of one segment whereas, except in *Amphibolothrips* and possibly several other genera, the mid and hind tarsi are each two-segmented. Each tarsus in *Amphibolothrips*, *Parallothrips*, *Preeriella*, and *Hydiorhynchus* appears to be one-segmented.

Special spurs may be formed on the fore legs (Figs. 13 and 14). When such spurs or teeth appear on the fore tarsus, as they frequently do, the fore legs are said to be armed. Spurs also may occur on the fore tibiae and fore femora. In thrips of certain genera rasp-and-file type

structures may be found on the fore legs. The rasp, a thickened corner at the base of the fore femur, may rub against a ridged file on the fore coxa (Hood 1950b). Trybom (1896) believed that the small clear disc areas at the base of the femur were auditory organs.

On all of the tibiae there are differentiated long setae which may act in a tactile capacity. Often there is one at the outer base and one at the outer apex of each tibia. Variations in their position and size provide taxonomic characteristics for the species and sometimes even for genera.

With the exception of certain species of one phyletic line, thrips of both suborders have the hind coxae placed closer together than the middle pair are to each other. In *Amphibolothrips* the hind coxae are placed farther apart than are the middle pair and in the African *Hoodiana* the hind coxae are the same distance apart as are the middle pair.

#### WINGS

The wings of the Tubulifera are distinct from those of the Terebrantia by reason of the combination of the nearly total lack of definite veins, the straightness of the fringe cilia, and the lack of microsetae on the surfaces. In the species of Phlaeothripidae, however, the base of the fore wings almost always exhibits a short vein that is provided with at least three stout setae. The form and length of these setae serve as diagnostic characteristics. Other wing features used taxonomically are the contour, the width, the presence or absence of accessory fringe cilia at the apex along the trailing edge, the color, and the spacing of the fringe cilia. To date, little diagnostic use has been made of the form of the hind wings.

What remains of the anal region of the fore wing is reduced to a small area at the base of the wing. This distinct hind angle of the fore wing is called the *scale* (Fig. 17). At its tip there are several stout curved setae which hook to the hind wing when the insect is in flight.

In the Phlaeothripidae there are various stages of wingedness. Macropterous forms have long, fully developed wings; micropterous forms, which are rare, have shorter but fully developed wings; and brachypterous forms always have wing pads representing the fore wings but there may be no trace left of the hind wings. Nonwinged, apterous forms not only lack wing pads but also even lack vestiges of the basal wing sclerites. Females have less tendency toward brachypterism than do males.

#### ABDOMEN

All thrips possess a 10-segmented abdomen. In the thrips of the Phlaeothripidae, the intermediate segments are composed simply of a tergal sclerite and a ventral sclerite, and the last segment, segment X, is drawn



out into a more or less cylindrical tube. Species in the Phlaeothripidae are characterized by the absence of abdominal pleural sclerites.

*Pelta.* With rare exceptions, the tergum of abdominal segment I bears a separate sclerite, which I named the pelta (Stannard 1954b), (Fig. 21, PEL). Its size, shape, and type of reticulations vary interspecifically. Seemingly it is surrounded by membrane but more likely it is set apart because the adjoining areas of the first tergite have broken into tiny sections or platelets. Unlike that in the Terebrantia, the tergum of abdominal segment I in the Tubulifera is tightly joined to the second segment, separated in most cases by only a thin suture.

*Tube.* A clearly definable tube is present in both sexes. This tube is without any longitudinal split lines either on the dorsal or ventral surfaces. Several tube shapes occur. Some are slender straight cylinders, others are arched cylinders, some are greatly thickened at the base, some are short, and others extraordinarily long. Invariably when the tube becomes unusually long, it also becomes somewhat bowed. The tube is usually reticulated either by faint scalelike markings at the base, by hexagonal designs, or by longitudinal ridges. Rarely, a few species are characterized by extremely hairy tubes.

*Setae.* Along the median portion of the dorsum of the intermediate tergites, several setae have been modified into sigmoidal spines (Fig. 20). These setae are termed the wing-holding setae because they interlace with the fringe cilia of the wings when the wings are at the rest position. To disengage the fringe cilia from the wing-holding setae it is necessary for the thrips to flip the abdomen upward. All macropterous forms have these setae fully developed. Brachypterous forms may lack them or retain them as weakly or fully differentiated setae.

Usually, but not always, in the members of the Phlaeothripidae there is a transverse row of sternal setae across the middle of the intermediate segments. These setae are in addition to the posterior ones. The absence or the size and position of these middle setae can be definitive characteristics.

At the end of the tube there are four or six long setae interspersed with shorter setae. Terebrantians often exhibit similar setae but, in the members of the two suborders, there is a fundamental difference in the attachment of these setae. In all of the Terebrantia, anal setae, except for some minor ones, arise directly from the last segment. In all of the Tubulifera these homologous setae arise from tiny plates that are separated from the main part of the last segment by membrane. Always the anal setae are pointed.

Other abdominal setae, variously located, are at times useful taxonomic characters. No special names, except place names or numbers, have been given them.

*Sternal glands.* Males of certain phyletic lines exhibit differentiated granular areas, usually on abdominal sternite VIII but occasionally also on some anterior sternites. These areas, presumably glandular, vary in shape and extent and can be used for diagnoses of the species.

*Sexual differentiation.* The sexes may be recognized by an examination of the tube. Each female has a small rod-shaped structure within her body at the base of the tube, the ventral and dorsal margins of the tube being similar and not emarginate. Males lack this internal rod and the venter of the tube is deeply emarginate. Often the male genital capsule can be seen within the eighth abdominal segment. In most phyletic lines, with the exception of those belonging to the Megathripinae, the males usually have the major lateral pair of posterior setae on abdominal tergum IX considerably shortened and spinelike.

#### FORMS

Thrips, especially those in the Phlaeothripidae, are analogous to termites and ants and bees in their production of forms. In the Phlaeothripidae, these forms are not castes in the sense that each is fitted for special duties; rather, they are similarly produced by heterogonous growth. Hood (1940b) suggested that the production of forms is directly correlated with the condition of the environment, particularly the food supply. It is doubtful that these thrips grow into different types of adults because of an interchange of hormones as in the termites, although it is interesting to note that the greatest form differentiation occurs only in those species which are gregarious and not solitary.

Males tend to have a wider range of atypical developmental variation than do the females. Frequently the bizarre forms occur without wings, as though whatever metabolic reserves that would have gone into the growth of wings had been diverted to other parts of the body. Perhaps the female is less subject to extraordinary body development at the sacrifice of wings in order that she may be better able disseminate eggs for the assured continuance of the species. Regardless of the reasons, females are more often normal and winged, and if they do have unusual variations, these developmental peculiarities are not as extreme as in the male.

These adult forms are in addition to the several kinds of winged forms: macropterous, micropterous, and brachypterous. Furthermore, there are also apterous forms. Between the two extremes listed below, there is a gradual transition of types.

*Minor forms.* Individuals are said to be minor forms if they are no more developed than is the minimum for the species. This is the normal form, the gynaeceoid form.



*Major forms.* A heavier, stouter-bodied individual can be termed a major form. In particular the head, fore legs, and prothorax are greatly enlarged. Occasionally the pelta of these forms is broadened, and appendages or stout spines may develop on various parts of the body including the abdomen. As mentioned previously, wings are often reduced in size or absent. These are the bizarre forms, the oedymorous forms.

## Classification

The suborder Tubulifera containing the single family Phlaeothripidae is presently considered to be further divisible into only two subfamilies, the Megathripinae and the Phlaeothripinae. Priesner (1949) recognized three more subfamilies, but I do not feel that these subdivisions merit such high rank. In the following discussions the genera are grouped alphabetically under their respective subfamilies. In the key these genera are placed in the couplets separately, not by subfamilies.

The subfamily Megathripinae is employed here more in the broad sense of Priesner (1928a) than in the restricted sense of Karny (1921). I have expanded the scope of this subfamily to include not only most of the genera included by Karny and Priesner but also many others such as degenerate forms like *Allothrips*, as well as specialized forms like *Pygothrips*.

Priesner (1928a) defined the subfamily as that division of the Tubulifera which contains species that, while having other characteristics, have bandlike maxillary stylets and have the third antennal segment wide at the base and broadly joined to antennal segment II in the larval stages. As I interpret this subfamily, the broad, bandlike appearance of the maxillary stylets remains as a consistent characteristic, but the larval antennal characteristic is no longer diagnostic. I have previously proposed two other definite features of this subfamily (Stannard 1954b). They are negative, secondary sexual characteristics of the male and in combination they seem to be reliable points for the recognition of all those members of the genera that I have seen. These two additional features are: (1) the lateral, posterior pair of setae on abdominal tergum IX of the male are never spinelike nor more reduced than those of the female, and (2) abdominal sternal glandular areas are never present in any of the males.

In the other subfamily, the Phlaeothripinae, the opposite of the three aforementioned characteristics is usually found to be true but not without complications. In certain members of the Phlaeothripinae belonging to borderline genera, the maxillary stylets are broader than is typical. Despite this intergrading condition, these species can be readily placed in the Phlaeothripinae by the features of the male sex, that is, by the presence of spinelike, short, lateral posterior setae on abdominal tergite IX, and/or by the presence of abdominal glandular areas. In other species

of the Phlaeothripinae whose males have the lateral setae of abdominal tergite IX long and not spinelike, the abdominal glandular areas are present, and/or the maxillary stylets are definitely slender and not at all broadened as in the thrips of the Megathripinae.

Despite the fact that, for their definition, it is necessary to use a combination of characteristics which may seem cumbersome, these two subfamilies most certainly are good taxonomic units that represent natural groups of genera. An analysis of their supposed phylogeny is given in a later section of this work.

#### KEY TO ADULTS OF THE NORTH AMERICAN GENERA

The key to and the descriptions of the genera presented herein pertain to perfect adult specimens. In some cases it is necessary to macerate dark specimens with a strong basic solution to observe the structures mentioned. Usually specimens mounted in Hoyer's medium (Baker and Wharton 1952) show to best advantage. A good research microscope and lamp which can be set up for Köhler illumination are prerequisites for the study of these tiny insects.

This key was designed as a guide solely to the North American representatives so far described. The genera *Ceuthothrips*, *Teuthothrips*, *Rhaphothrips*, and *Barythrips* have been omitted for the reasons given in the account of these genera. *Tylothrips* Hood (1937b), an obscure genus containing two species, each based on a single specimen neither of which is available to me, was not included in this key or in any of the discussions because its discovery in North America was not made known until June, 1955, at which time this study was essentially completed. A group of the more difficult genera, some of which were included only in part in the key, were compared by their principal characteristics in Table 2. So much additional revisionary work needs to be done on these difficult genera that many of them cannot be accurately keyed in the conventional manner at present.

1. Hind coxae placed farther apart from each other than are the middle coxae from each other.....2  
    Hind coxae placed closer together than are the middle coxae to each other .....4
2. Without prominent anterior head setae (Fig. 47).....  
    .....*Amphibolothrips* subgenus *Trachythrips*  
    With 1, 2 or 3 pairs of prominent anterior head setae (Figs. 48, 49)  
    .....3
3. Having 4 long anal setae; antenna 7-segmented.....  
    .....*Amphibolothrips* subgenus *Baenothrips*

- Having 6 long anal setae; antenna 4- or 5-segmented. ....  
 ..... *Amphibolothrips* subgenus *Stephanothrips*
4. Posterior margin of abdominal sternite VIII with several long finger-like projections ..... *Chirothripoides*  
 Posterior margin of abdominal sternite VIII straight. .... 5
5. Many of the body and wing setae inverted L-shaped (Fig. 22); morphological segments III and IV of the antenna often fused. ....  
 ..... *Hyidiothrips*  
 Body and wing setae pointed, clubbed at tip, or funnel-like, never inverted L-shaped; morphological segments III and IV of the antenna never fused. .... 6
6. Thoracic sterna with a median, longitudinal ridge connecting the mesofurca and the metafurca; antennal segment III cup-shaped, antennal segment IV globular; slender tiny thrips. .... *Preeriella*  
 Thoracic sterna without such ridge, or ridge incomplete except rarely in apterous forms in which the metafurca is placed close to the mesofurca; antennal segment III never cup-shaped, often elongate. .... 7
7. Antenna 6-segmented, terminal segment broad and long, formed by the union of morphological segments VI, VII, and VIII. .... 8  
 Antenna 7- or 8-segmented. .... 9
8. Abdominal segment IX with 4 pairs of stout, thornlike setae in addition to the usual 3 long slender pairs. .... *Pygidiothrips*  
 Abdominal segment IX without thornlike setae, with only the usual slender setae ..... *Priesneriella*
9. Tube greatly swollen at base, parabolic in outline. .... *Pygothrips*  
 Tube cylindrical; if somewhat swollen at base, not parabolic in outline ..... 10
10. Maxillary stylets extremely long, each stylet looped 3 times within the head and mouth cones (Fig. 81). .... *Docessissophothrips*  
 Maxillary stylets not as long; each stylet looped, not more than once within the head or mouth cones. .... 11
11. Pronotum reduced to a shield surrounded by tiny sclerotized platelets (Fig. 43). .... *Plectrothrips*  
 Pronotum uniformly sclerotized (Fig. 42). .... 12
12. Abdomen without a transverse, median row of setae on most of the sternites ..... *Metriothrips*  
 Abdomen with a transverse, median row of setae on most of the sternites ..... 13
13. Tube hairy; maxillary stylets broad. .... 14  
 Tube not particularly hairy; maxillary stylets slender or broad. .... 19

14. Antennal segments III and IV with numerous sense cones on venter near apex ..... *Hybridothrips*  
Antennal segments III and IV with 4 or less sense cones ..... 15
15. Antennal segment I with a differentiated, long, dorsal seta ..... 16  
Antennal segment I without any unusually developed setae ..... 18
16. Cheeks without or with only 1 pair of enlarged prominent setae (Fig. 83) (applicable to the known North American species only) .....  
..... *Zeugmatothrips*  
Cheeks with at least 2 pairs of enlarged, prominent setae ..... 17
17. Dorsum of head with only 1 pair of enlarged median setae .....  
..... *Actinothrips*  
Dorsum of head with 3 pairs of enlarged median setae .. *Zeuglothrips*
18. Head elongate; prothorax unusually short (Fig. 90) .. *Megalothrips*  
Head shorter; prothorax not unusually short. .... *Megathrips*
19. Anterolateral and midlateral prothoracic setae placed close together (Figs. 50, 98), and praepectus always absent ..... 20  
Anterolateral and midlateral prothoracic setae not placed exceptionally close together; if close together, praepectus present, otherwise praepectus absent or present ..... 21
20. Head elongate with postocular setae placed far behind eyes (Fig. 50); antennae each 8-segmented ..... *Craniothrips*  
Head shorter with postocular setae placed closer to eyes; antennae each 7-segmented. (This couplet and its placement in the key are based on the type species and not on the North American species purported to belong here.) ..... *Trichinothrips*
21. Antennal segment I bearing an extremely differentiated dorsal seta which is dilated at tip ..... *Atractothrips*  
Antennal segment I usually without any single outstanding seta, although not all dorsal setae are equal in length; setae usually pointed or blunt at tip; if dilated at tip then setae are short and several such setae are present ..... 22
22. Abdominal sternites VII and VIII with differentiated glandular areas ..... males of *Holopothrips*  
Abdominal sternite VIII only, with differentiated glandular areas or these areas entirely lacking ..... 23
23. Antennal segment III drawn out into a point at apex (Fig. 11) .....  
..... *Goniothrips*  
Antennal segment III without a prominent pointed angle at the apex ..... 24



24. Antennal segment III with a shelflike base (Fig. 9) . . . . . *Agrothrips*  
Antennal segment III without a shelflike process around base . . . . . 25
25. Pelta, in the middle, with small decumbent setae, or spines (Figs. 134, 136) . . . . . 26  
Pelta, in the middle, without setae or spines (Fig. 132) . . . . . 27
26. Cheeks with large, seta-bearing warts (Fig. 74) . . . . . *Eupathithrips*  
Cheeks without such warts . . . . . *Sedulothrips*
27. Eyes touching or nearly so (Fig. 72); mouth cones pointed; cheeks without large setae or warts . . . . . *Macrophthalmothrips*  
Eyes not touching, if large and placed fairly close together, either mouth cones broadly rounded or cheeks with large setae or warts . 28
28. Last 2 antennal segments partially or completely fused (Fig. 8), reducing the number of segments to 7 . . . . . 29  
Last 2 antennal segments not fused, segments VII and VIII completely separated by a continuous suture, segment VIII often independently movable . . . . . 44
29. Antennal segment III decidedly smaller than segment IV, usually smaller than segment II . . . . . 30  
Antennal segment III equal to or longer than segment IV and segment II separately . . . . . 32
30. Antennal segment II with dorsal sensorium positioned near the middle of that segment . . . . . *Williamsiella*  
Antennal segment II with dorsal sensorium positioned near the apex of that segment . . . . . 31
31. Mouth cones broadly rounded . . . . . *Phthirothrips*  
Mouth cones nearly pointed . . . . . *Trisclerothrips*
32. Maxillary stylets when at rest just barely retracted into the head (Fig. 41) . . . . . 33  
Maxillary stylets when at rest retracted far into the head (Fig. 43) . . . . . 34
33. Praepectus absent . . . . . *Zaxenothrips*  
Praepectus present . . . . . *Sophiothrips*
34. Tube strongly hexagonally reticulate, similar to Fig. 34 . . . . . *Chamacothrips*  
Tube not strongly hexagonally reticulate; either smooth, scalloped, or longitudinally ridged . . . . . 35
35. Eyes kegl like or moruloid; head strongly hexagonally reticulate (Figs. 61-63) . . . . . 36  
Eyes not particularly bulged from the head (Figs. 49, 66); head usually not strongly hexagonally reticulate . . . . . 37

36. Head entirely covered by hexagonal reticulations, as in Fig. 61; maxillary stylets slender.....*Glyptothrips*  
 Head on the mid-dorsum, at least, without strong hexagonal reticulations (Fig. 93); maxillary stylets broad.....*Illinothrips*
37. Head roughened by irregular ridges (Fig. 46).....38  
 Head smooth or weakly reticulate or transversely striate.....39
38. Epimeral sutures complete, reaching the posterior margins of pronotum .....*Idiothrips* (*Strepterothrips*)  
 Epimeral sutures incomplete, not reaching the posterior margins of the pronotum.....*Idiothrips* (*Stegothrips*)
39. Eyes, dorsally, reduced to 4 to 6 facets (Fig. 95); always lacking fully developed wings (apterous or brachypterous); pelta large (Fig. 139) .....40  
 Eyes, dorsally, larger, usually with 10 or more facets; if with less than 10 facets, pelta smaller (Fig. 125).....41
40. Mid and hind tarsi, each 2-segmented.....*Allothrips*  
 Mid and hind tarsi, each 1-segmented.....*Parallothrips*
41. Epimeral sutures complete, reaching the posterior margins of the pronotum; head reticulations usually upturned on the meson; often with cheek pouches behind the eyes (Fig. 80).....42  
 Epimeral sutures incomplete, not reaching the posterior margins of the pronotum; head transversely striate; never with cheek pouches.....43
42. Abdominal tergites without paired black spots.....  
 ..... many *Polyphemothrips*  
 Abdominal tergites III to VIII each with a pair of black spots.....  
 .....*Symphiothrips*
43. Tube short, less than half the length of the head.....*Trichinothrips*  
 Tube longer, about four-fifths the length of the head.....*Zaliothrips*
44. Fore wings with hexagonal reticulations on upper surface.....  
 .....*Stictothrips*  
 Fore wings without hexagonal reticulations, occasionally marked with short lines which do not form geometric designs, or without wings.....45
45. Head as in Fig. 84, prolonged between antennae, and prolongation cleft.....*Goctothrips*  
 Head without such cleft prolongation.....46
46. Most of the prominent lateral setae of the abdomen extremely clubbed or funnel-shaped, at least half the length of each of these setae enlarged (Fig. 45).....47

- Prominent lateral abdominal setae not excessively clubbed at apex, often pointed; if dilated, stem of seta proportionately much longer than that part which forms the club. . . . . 48
47. Last three antennal segments compactly united. . . . . *Rhopalothrips*  
 Last three antennal segments not closely united. . . . . *Scopaeothrips*
48. Fore wings faintly cross banded by 4 light brown streaks including the band at the tip and the band at the extreme base. *Aleurodothrips*  
 Fore wings not banded by 4 distinct cross streaks. . . . . 49
49. Probasissternal sclerites fused into one unit (Fig. 25) . . . . . some *Orthothrips*  
 Probasissternal sclerites paired, not fused (Fig. 23) . . . . . 50
50. Wing-holding seta expanded, leaflike (Fig. 20) . . . . . 51  
 Wing-holding seta spinelike (Fig. 33) or absent. . . . . 52
51. Cheeks with enlarged, seta-bearing warts (Fig. 18) . . . . *Neurothrips*  
 Cheeks without enlarged warts (Fig. 62) . . . . . some *Orthothrips*
52. Maxillary stylets short, barely retracted into the head capsule (Figs. 37-42) . . . . . 53  
 Maxillary stylets longer, retracted far into the head capsule (Fig. 43) . . . . . 55
53. Postocular setae minute. . . . . *Puebllothrips*  
 Postocular setae well developed, longer. . . . . 54
54. Pelta much wider than long (Figs. 103, 104) . . . . . *Sophiothrips*  
 Pelta longer than wide, triangular in shape. . . . . *Antillothrips*
55. Pronotal striae twisted into swirls. . . . . *Gynaikothrips*  
 Pronotal striae more or less transversely arranged or absent; if with suggestions of swirls, then eyes prolonged ventrally. . . . . 56
56. Cheeks with enlarged, seta-bearing warts (Fig. 18) . . . . . most *Acanthothrips*  
 Cheeks without such enlarged warts. . . . . 57
57. Antennal segment III extremely small; smaller than either segment II or IV. . . . . *Lissothrips*  
 Antennal segment III just slightly smaller, subequal to, or longer than segment IV. . . . . 58
58. Pterothorax much smaller than pronotum; with lateral white dots on certain abdominal segments; antlike in appearance. . . *Oedaleothrips*  
 Pterothorax larger or only slightly smaller than the pronotum; usually without white markings on the abdomen; not resembling ants. . . 59
59. Head with several pairs of well-developed cheek spines; with large eyes; fore tibia with more than one enlarged tubercule. . . *Pristothrips*



- Either without large cheek spines, or with medium to small eyes, or without tubercules, or with only one tubercule on the fore tibia... 60
60. Head with conspicuous cheek pouches behind eyes (Fig. 80)..... some *Polyphemothrips*  
Head without cheek pouches..... 61
61. Praepectus very large, about 3 times as long as greatest length of probasisternum (Fig. 24)..... *Podothrips*  
Praepectus smaller, never more than twice as long as greatest length of probasisternum, or praepectus absent..... 62
62. Area adjacent to mesothoracic spiracle with spinelike process (Fig. 19)..... ♂s of *Illinothrips* and some *Nesothrips*  
Area adjacent to mesothoracic spiracle without spinelike process.. 63
63. Cheeks set with several heavy setae (Fig. 82); abdomen, especially toward the apex, with setae extremely elongate..... *Diceratothrips* subgenus *Endacnothrips*  
Cheeks not set with heavy setae, or abdominal setae not especially elongate . . . . . 64
64. Head entirely covered by strong hexagonal reticulations; always with praepectal plates; fore wings, when present, without accessory cilia . . . . . 65  
Head, usually on the mid-dorsal region lacking hexagonal reticulations, with or without praepectal plates, and with or without accessory cilia on fore wings (if head completely covered by reticulations, fore wings with accessory cilia)..... 67
65. Tube with hexagonal reticulations . . . . . *Eschatothrips*  
Tube without hexagonal reticulations..... 66
66. Postocular setae long (Fig. 61)..... *Erkosothrips*  
Postocular setae shorter (Fig. 62)..... *Orthothrips*
67. Ocellar setae extremely long (Fig. 53); lateral setae of abdominal segments VII and VIII strongly wavy..... *Trybomia*  
Ocellar setae short, or lateral setae of abdominal segments VII and VIII nearly straight..... 68
68. Prothoracic epimeral sclerites each with 2 well-developed setae. . 69  
Prothoracic epimeral sclerites each with but 1 well-developed seta. . . . . 70
69. Metanotum with longitudinal striations; never with white body stripes..... North American species of *Phrasterothrips*  
Metanotum more nearly hexagonally reticulate; often with white body stripes. . . . . some *Acanthothrips*

70. Apexes of distal arms of maxillary stylets slender, each rarely even as wide as one-half the width of the labial palps, rarely forming a V within the head, more often sigmoidal or with arms parallel; pelta usually, but not always, confined to the median portion of the tergum of abdominal segment I (Fig. 118).....71  
 Apexes of distal arms of maxillary stylets broad, bandlike, nearly the width of labial palps, usually forming a V within the head; pelta always large (Fig. 140).....77
71. Most of the abdominal segments more than one and one-half times as long as wide.....*Gigantothrips*  
 Most of the abdominal segments wider than long.....72
72. Eyes, on the dorsum, about as close together posteriorly as a distance equal to or less than the width of antennal segment I..*Holopothrips*  
 Eyes, on the dorsum, decidedly farther apart posteriorly than a distance equal to the width of antennal segment I.....73
73. Eyes kegl-like, small and bulged from the head (Figs. 59, 60); praepectus always present; mouth cones broadly rounded....*Eurythrips*  
 Eyes rarely kegl-like; if so, with either praepectus absent or mouth cones pointed .....74
74. Head elongate as in Fig. 55; maxillary stylets touching within the center of the head; fore wings not indented in the middle; mesonotum stippled anteriorly.....*Thorybothrips*  
 Not with the above combination of characteristics.....75
75. Fore wings broad and bulged at base.....*Treherniella*  
 Fore wings never particularly bulged at base or wings reduced to pads or absent.....76
76. Head with one to several depressed lines or wrinkles behind eyes; always on *Yucca*.....many *Bagnalliella*  
 Head without wrinkles behind eyes; not confined to *Yucca*. (The difficult genera of the Phlaeothripinae which are in need of further revision)..... Table 2
77. Eyes, dorsally, reduced to but a few (approximately 6) large facets (Fig. 94) .....*Pseudocryptothrips*  
 Eyes, dorsally, with more than 10 facets.....78
78. Maxillary stylets nearly touching in the center of the head, distal arms sigmoidal in shape (Fig. 88).....*Cryptothrips*  
 Maxillary stylets V-shaped, spaced far apart within the center of the head, distal arms straight.....79
79. Head at least twice as long as wide, usually with characteristic constriction of cheeks a short distance behind eyes (Fig. 92).....80

TABLE 2. CHARACTERISTICS OF THE DIFFICULT GENERA OF PHLAEOTHIRIPINAE

X — usually having condition stated  
 (X) — occasionally having condition stated

	Acanthothrips	Adraneothrips	Bagnalliella	Cephalothrips	Gnophothrips	Eurythrips	Haplothrips	Hoplandrothrips	Liothrips	Lisothrips	Lissothrips	Malacothrips	Neothrips	Phlaeothrips	Pocilothrips	Polyphemothrips
Antennal segment III vasiform	X															
Cheeks with enlarged warts	X															
Eyes prolonged ventrally		X		X			(X)				(X)					
Most antennal segments bicolored		X		(X)							(X)					
Living on <i>Yucca</i>			X												X	
Accessory fringe cilia of wings absent				X	X	X										
Basal head reticulations up-turned toward meson									X	X			?			
Eyes moruloid						X										X
Cheeks with pouches											(X)					
Maxillary bridge definite, wide	(X)						X								(X)	
Metanotal sculpture strong	X			X	X				(X)							
Basal cheek setae prominent							X	(X)			X					
Feeders on living green plants		X		X		(X)		X		X			X			
Mouth cones long, pointed	X			X		(X)	X	X	(X)		(X)	X	(X)	X	(X)	
Mesopraesternum entirely absent																
Antennal segment III small						(X)			X							
Small eyes on side of head										X						
Body with white lateral stripes	(X)											X				
Praepectus present		X			X	X				X				X		
Wrinkles behind eyes		X								X						

- Head usually less than twice as long as wide; if nearly twice as long as wide, sides of head straight or slightly bulged, not with constriction (Figs. 85, 89).....82
80. Mesopraesternum wider than the width of either anterior lateral margin of mesoeusternum (Fig. 28).....*Sporothrips*  
 Mesopraesternum not as wide as the width of either anterior lateral margin of the mesoeusternum (Fig. 30).....81
81. Median pair of metanotal setae slender; mesopraesternum extremely narrow . . . . .*Elaphrothrips*  
 Median pair of metanotal setae enlarged; mesopraesternum wider . . . . .*Anactinothrips*
82. Head rectangular-shaped; cheeks straight (Fig. 89)..*Diceratothrips*  
 Head oval to elongate with bulged cheeks; never rectangular-shaped (Figs. 85-87) .....83
83. Eyes bulged from head in manner of *Eurythrips* (Fig. 93).....*Illinothrips*  
 Eyes not bulged from head.....*Nesothrips*

#### SUBFAMILY PHLAEOTHIRIPINAE KARNY 1921

This subfamily comprises those members of the Tubulifera that have the maxillary stylets slender, whose males often have abdominal glandular areas, and whose males often have the lateral pair of posterior setae on abdominal tergum IX spinelike or shorter than in the female.

#### *Acanthothrips* Uzel

*Acanthothrips* Uzel (1895:259). Type species by monotypy: *Phloeothrips* [sic] *nodicornis* Reuter.

*Notothrips* Hood (1933b:200). Type species by original designation: *Phlaeothrips vittatus* Hood. New synonymy.

Medium-sized to large thrips with large but not closely adjoined eyes, without a pair of large basal cheek setae, often with enlarged cheek warts, and with prominent head horns in one or both larval stages.

*Head.* Elongate, cheeks slightly expanded (Figs. 75, 78); eyes large, bean-shaped, not adjoining on the dorsum; lateral cheek warts often prominent; posterior cheek setae not proportionately larger than other cheek setae; intermediate antennal segments often vase-shaped; post-ocular setae usually large, rarely small.

*Mouth parts.* Mouth cones long, pointed; slender maxillary stylets retracted far into the head touching within the center of the head.

*Thorax.* Pronotum with one or two pairs of prominent epimeral setae; notum hexagonally reticulate or marked by small, closely spaced granules;

praepectus absent; mesopraesternum well developed to slightly degenerate; fore wings somewhat broadened, slightly indented in the middle, sometimes median streak absent.

*Abdomen.* Pelta small, often trapezoidal (Figs. 132, 133); tube moderate in length; anal setae less than twice as long as tube.

*Larvae.* Prominent head horns present in at least instar II.

Most, but not all, of these thrips have white stripes or dots along the dorsolateral margins of the body. A wide range of this white coloring occurs. Some species such as *Aca. amoenus* from Brazil and *Aca. albivittatus* of North America have white stripes running from the posterior corners of the eyes down to the last few segments of the abdomen. Others such as *Aca. nodicornis*, a Holarctic species, has only white dots on several of the abdominal segments, whereas the European *Aca. coriaceus* has no evidence of any white markings. This characteristic of white vittae or spots usually so noticeable in the *Acanthothrips* is not a singular criterion for their recognition because *Poecilothrips*, *Neurothrips*, *Eupathithrips*, *Sedulothrips*, *Macrophthalthothrips* and even some other genera of the Phlaeothripinae also have much the same marks in one degree or another.

This genus seems justifiably separated as a phylogenetic entity on the basis of the form of the larvae. Large head horns appear in the second instar of those larvae that are known (*nodicornis*, *coriaceus*, and *albivittatus*), and it is because of these structures that it was postulated that all of the species are of a common origin. Such head horns are found in only three other genera, *Pselaphothrips* and *Eupathithrips*, close relatives of *Acanthothrips*, and *Eurytrichothrips*, a relative of *Plectrothrips*. Adult characteristics that might be used to segregate this unit from others are less striking. Arbitrarily, the presence or absence of a larger basal cheek spine was selected as the determining factor for separating *Acanthothrips* and *Hoplandrothrips*, inasmuch as many *Acanthothrips* larvae are unknown. *Acanthothrips* has no larger spines at the base of the cheek; species of *Hoplandrothrips* do have a distinctly larger pair.

*Notothrips* was erected for several *Acanthothrips*-like species principally on the basis of the presence of two large setae on the prothoracic epimeron and the forward extension of several abdominal sternites of the males. Most Tubulifera have two setae on the epimeron and occasionally the inner one becomes enlarged as in the case of *Stictothrips faurei* in comparison with the closely related *Stictothrips maculatus*. Even *Acanthothrips albivittatus* has two large setae on each epimeral sclerite, and males of *albivittatus* have a slight extension of the seventh and eighth abdominal sternites in the same fashion described for *Notothrips*. Because these two main characteristics of *Notothrips* are not outstanding there seems to be little need to keep *Notothrips* as a separate complex.



As a group, *Acanthothrips* stands in an evolutionary scale between *Hoplandrothrips* and the genus *Neurothrips*. Even including white spots on the abdomen, the general morphology of *Hoplandrothrips chapmani* and *Hoplandrothrips picticornis* is most similar to several species of *Acanthothrips*; but *chapmani* and *picticornis* have enlarged basal cheek spines typical of the *Hoplandrothrips*. Within *Acanthothrips* the species form a graduated sequence from those nearest *picticornis* to *Acanthothrips amoenus* which is remarkably like *Neurothrips*. *Neurothrips* has been kept separate because it can be clearly recognized by the flat, enlarged wing-holding setae and by the long tube setae which are more than twice the length of the tube. Even so, *Neurothrips* is closely related to those *Acanthothrips* with large cheek warts, extensive white vittae, and vase-shaped intermediate antennal segments.

The five North American species are:

albivittatus Hood 1908a:374.....	Eastern U.S.A.
folsomi (Hood), Notothrips (1933b:201).....	Colorado
itzanus new species.....	Mexico
nodicornis (Reuter), Phloeothrips [sic] (1880:16).....	Holarctic
<i>americanus</i> Bagnall (1933:123)	
<i>doanei</i> Moulton (1907:64)	
vittatus (Hood), Phloeothrips [sic] (1912a:11).....	Eastern U.S.A.

#### *Acanthothrips itzanus* new species

*Male* (macropterous). Length, distended, exclusive of the antennae, about 4.3 mm. General color dark brown with white lateral stripes. Dark brown: most of head, thorax, and abdomen, antennal segments I and II, most of the legs, and median wing streaks. Yellow: portions of most of antennal segments III to VI, most of the fore tibia, the apices of the middle and hind tibiae and all tarsi; antennal segments VII and VIII yellow-brown to brown. White: lateral dorsal head and prothoracic stripes, lateral spots on the pelta, and anterior lateral spots on abdominal segments III, IV, and V. Red: subintegumental pigments of the body.

Head as in Fig. 75; eyes large and positioned fairly close together; postocular setae small; cheeks with many seta-bearing warts; intermediate antennal segments vasiform, segment VIII broadly attached to segment VII.

Pronotum (Fig. 75), hexagonally reticulate; all major pronotal setae well developed, with two large setae on each epimeral sclerite similar to *vittatus* and *albivittatus*; mesopraesternum somewhat degenerate; fore femur with a large bilobed spur on the inner side near the apex; fore tibia with a large spur on the inner side near the base; fore wings slightly indented in the middle with an out-turned angle on the middle of the central streak, with many accessory fringe cilia.

Abdominal segment I with a trapezoidal to bell-shaped pelta; seemingly with a glandular area on sternite VIII.

*Female* (macropterous). Similar to male in size and general structure.

*Holotype*: Male; Chichen Itza, Yucatan; June 27, 1951 (L. J. Stannard); from dead limbs. *Allotype*: Female; same data as for holotype, except June 30, 1951. *Paratypes*: 3♂s; same data as for holotype, except June 29, 1951.

This species resembles *Aca. albivittatus* in many respects. It differs, however, from that species in several major points. In *itzanus* the pronotum is hexagonally reticulate and the cheek warts are large and conspicuous. In *albivittatus* the pronotum is marked by granules and the cheek warts are small.

### Adraneothrips Hood

*Adraneothrips* Hood (1925b:54). Type species by original designation: *Haplothrips* (?) *tibialis* Hood.

*Hypothrips* Priesner (1933a:57). Type species by original designation: *Hypothrips desocellatus* Priesner. New synonymy.

Weakly sclerotized, small Tubulifera usually with most antennal segments bicolored dark and light, often with the eyes elongated on the ventral surface of the head, and often with the sides of the body and head bordered by subintegumental pigments.

*Head*. Weakly sclerotized, eyes usually extended posteriorly to a point on the ventral surface of the head; antennae inserted forward of the anterior eye margin, most segments light at base and dark at apex, segment VIII slender.

*Mouth parts*. Mouth cones broadly rounded; slender maxillary stylets usually retracted far into the head, spaced fairly far apart within the head.

*Thorax*. Notum weakly marked; praepectus absent; mesopraesternum degenerate; fore wings usually narrowed in the apical half, fringe cilia spaced fairly far apart; epimeral sutures complete.

*Abdomen*. Pelta small in macropterous forms (Fig. 138), somewhat larger in brachypterous forms; anal setae usually much shorter than the tube.

This genus can be related on the one hand to *Cephalothrips* and on the other hand to *Hoplandrothrips*. Both *Cephalothrips* and *Adraneothrips* often have the ventral portion of the eyes elongated posteriorly into a point. *Cephalothrips* differs mostly by the shape of the antennae. *Hoplandrothrips* seems related to *Adraneothrips* because of the similarity of head form. Bridging these two genera are species of *Malacothrips* which may occasionally resemble *Adraneothrips* even to color pattern. *Malacothrips* usually has larger eyes and *Hoplandrothrips* is always more strongly reticulate than *Adraneothrips*. All of these groups seemingly are derived from primitive *Phlaeothrips* stock.



If *Adraneothrips* is to be maintained as a genus, then the dividing line between it and *Phlaeothrips* and *Malacothrips* and possibly even *Haplothrips*, may be an arbitrary choice, pending a thorough study of these difficult genera. Both *Adr. stenocephalus* and *exiguus* could be considered *Adraneothrips* or *Phlaeothrips*. Between these species and typical *Adraneothrips* stands *Adr. pinicola*. *Adr. pinicola* bears a small pelta much as *Adraneothrips* or *Carathrips* but in appearance it resembles *Phlaeothrips*.

The antennal coloration in combination with the characteristic of the elongated eyes is ordinarily distinctive of *Adraneothrips*. The species are most difficult to determine, principally because no review or analysis of the recognized forms is available.

Nearly forty species have been described. For this study I have examined about one dozen species. Many of these are apparently new species from Mexico, California, and the Pacific Islands.

The recorded North American species are:

abdominalis Hood (1925b:55).....	Cuba, St. Thomas
albicollis Hood (1935a:89).....	Panama
alternatus Hood (1925b:55).....	Panama
bellus (Hood and Williams), ?Haplothrips (1915:125)...	Florida
bilineatus Hood (1935a:85).....	Panama
cinctiventris Hood (1942:593).....	Florida
decorus Hood (1938c:364).....	Southeastern U.S.A.
desocellatus (Priesner), Hypothrips (1933a:57).....	Mexico
diligens Hood (1935a:87).....	Panama
ephippium Stannard (1956b:24).....	California
exiguus (Hood), Cryptothrips (1912d:154).....	Illinois
faustus Stannard (1956b:21).....	California
fuscollicis Hood (1925b:56).....	St. Lucia, B.W.I.
hoffi Stannard (1956b:23).....	New Mexico
huachucae Hood (1927f:202).....	Arizona
pallidus (Watson), ?Gastrothrips (1924:50).....	Florida
pinicola Hood (1938c:357).....	Florida
poecilonotus Hood (1939:580).....	Texas
rostratus Hood (1938c:368).....	Florida
stenocephalus Hood (1938c:362).....	Florida
tibialis (Hood), ?Haplothrips (1914b:39).....	Neotropical
vacuus Stannard (1956b:23).....	California
xanthosoma Hood (1938c:360).....	Florida

### **Agrothrips Jacot-Guillarmod**

*Agrothrips* Jacot-Guillarmod (1939:40). Type species by original designation:  
*Agrothrips priesneri* Jacot-Guillarmod.

Members of the Phlaeothripinae with a shelllike ring around the base of antennal segment III (Fig. 9).

I do not know for certain whether this generic name applies to any of our North American species and, even if it does, I am again not certain whether *Agrothrips* is necessarily the oldest available name.

Had all gone as Professor Priesner wished, *Hadothrips*, with *tenebricosus* the type species, would have been the name of this genus. Unfortunately, as Professor Priesner told me, *robiniae* was inadvertently copied into his manuscript and when published in 1949, *robiniae* and not *tenebricosus*, became irrevocably the type. The species *robiniae* is not at all like the North American species I wish to place here, whereas *tenebricosus* is much like them.

This genus is characterized principally by the shelflike ring around the base of each antennal segment III. Otherwise the species resemble those in *Haplothrips*.

In North America no other genus has such a shelflike projection on antennal segment III. Elsewhere several genera resemble *Agrothrips*. In the African *Jacotia* the species have antennal segment III similarly formed but they differ from species of *Agrothrips* in having the eyes greatly elongated dorsally. The Australian *Priesneria* Bagnall (not *Priesneria* Maltbaek, pre-occupied) also resembles *Agrothrips* in many characteristics, but the former is supposed to contain heavier-bodied insects, whereas the species of the latter are somewhat more slender. Members of *Prosantothrips* differ from those in *Agrothrips* in the characteristic of the thicker, ridged tube.

At least the following five North American species might be included.

*arenicola* (Hood), *Karnyothrips* (1938f:216) . . . . . Arizona  
*dimidatus* (Hood), *Watsoniella* (1939:576) . . . . . Texas, Kansas, Illinois  
*omani* (Crawford, J. C.), *Haplothrips* subgenus  
*Hadothrips* (1947c:250) . . . . . Arizona  
*pallidus* (Hood), *Zygothrips* (1912d:140) . . . . . Texas  
*tenebricosus* (Priesner), *Hadothrips* (1925c:318) . . . . . Mexico

### Aleurodothrips Franklin

*Aleurodothrips* Franklin (1909:228). Type species by monotypy: *Cryptothrips fasciapennis* Franklin.

*Chromatothrips* Schmutz (1913:1043). Type species by subsequent designation of Bagnall (1915a): *Chromatothrips fasciata* Schmutz. Synonymized by Bagnall (1915a).

*Microcanthothrips* Bagnall (1914:295). Type species by original designation: *Cephalothrips spinosus* Bagnall. Synonymized by Priesner (1949).

*Aleurodothrips* is a *Phlaeothrips* derivative worthy of full generic rank. In many respects it has the appearance of certain species now placed in *Phlaeothrips*. Its head is *Phlaeothrips*-like, the maxillary stylets are slender and placed far apart near the sides of the head, the mouth cones are broadly rounded, and seemingly no praepectal plates are present.

Although this genus is not spectacularly distinctive, it does have two definitive characteristics that can reliably be used for purposes of identification: one, the narrow fore wings are faintly cross-banded by four light brown streaks including the band at the tip and the band at

the extreme base, an unusual condition for thrips belonging to the Tubulifera; and two, the male bears a large spur on the inner side of the fore femur and the fore tibia has three large seta-bearing warts. Franklin (1909) and Bagnall (1914) illustrated this fore femoral spur. Females are usually without such armature but sometimes a small wart or raised area can be detected on the fore femur.

One species, the tropical tramp of unknown origin, *Aleurodothrips fasciapennis*, occurs in North America. Franklin, in 1909, reported that it is predaceous on white flies of orange trees. Other workers later reported that it feeds also on various scale insects.

### Amphibolothrips Buffa

This genus, composed of ten subgenera, had been previously separated into the family Urothripidae. Under this older system all of the groups were classed as full genera. In 1952, I combined these genera under *Amphibolothrips* because none of them exhibited features of singular distinction. The species in the several subgenera are warty, have long tubes bearing long anal setae, usually are bicolored brown and pale

TABLE 3. CHARACTERISTICS OF THE SUBGENERA OF *Amphibolothrips*

Subgenera of <i>Amphibolothrips</i>	Number of long anterior head setae				Number of long anal setae			Number of anterior segments			
	1 pr.	2 prs.	3 prs.	none	4	6	8	7	6	5	4
<i>Amphibolothrips</i> s. str.				X	X						X
<i>Baenothrips</i>			X		X			X			
<i>Bebelothrips</i>				X	X					X	
<i>Bradythrips</i>	X				X			X			
<i>Conocephalothrips</i>				X	X			X			
<i>Octurothrips</i>				X		X	X				
<i>Stephanothrips</i>	X	X	X			X				X	X
<i>Trachythrips</i>				X	*	X			X	X	
<i>Urothrips</i>				X		X		X			
<i>Verrucothrips</i>			X		X		X				

\* Abnormally.

yellow, are always apterous, lack ocelli, and the hind coxae are farther apart from each other than are the middle pair from each other. The following table of the subgeneric characteristics presents the major differences and similarities. Only three of these subgenera have representatives in North America. They are treated in more detail in the subsequent discussions.

#### Subgenus *Baenothrips* Crawford, J. C.

*Baenothrips* Crawford, J. C. (1948:39). Type species by original designation: *Baenothrips guatemalensis* Crawford, J. C.

The group of *Amphibolothrips* with three pairs of prominent anterior head setae, with four long anal setae, and seven antennal segments.

*Head.* Warty (Fig. 49); eyes with a few large facets arranged in two short rows dorsally; anterior of head with three pairs of prominent setae, the middle pair pointed at the tips; antennae seven-segmented, morphological segments VII and VIII fused.

*Mouth parts.* Mouth cones short, broadly rounded; slender maxillary stylets retracted far into the head, positioned well apart and parallel within the head.

*Thorax.* Epimeral setae the only major setae on the pronotum well developed; praepectus seemingly absent; mesopraesternum degenerate; meso- and metasterna apparently fused without a suture between them.

*Abdomen.* Tube about twice as long as segment IX, with four long anal setae.

Principally, this subgenus differs from the closely related South American *Bradythrips* Hood by the number of pairs of prominent anterior head setae and by the length of the tube. *Baenothrips* has three pairs of prominent head setae and the tube is about twice as long as abdominal segment IX; *Bradythrips* has only one pair of head setae and the tube is about one and one-half times longer than abdominal segment IX.

Only one species, based on a single specimen, is known. Crawford gave Guatemala City, Guatemala, as the type locality although the specimen was actually discovered in quarantine at San Francisco, California.

#### Subgenus *Stephanothrips* Trybom

*Stephanothrips* Trybom (1913:42). Type species by monotypy: *Stephanothrips buffai* Trybom.

The group of *Amphibolothrips* with one, two or three pairs of prominent anterior head setae, with six long anal setae, and with four or five antennal segments.

*Head.* Warty (Fig. 48); eyes each with three or four large facets in one short line dorsally; anterior of head with one, two or three pairs of



prominent setae; antenna four- or five-segmented, morphological segments III, IV, and V fused, VI, VII and VIII separated in part or entirely fused.

*Mouth parts.* Mouth cones short, broadly rounded; slender maxillary stylets retracted far into the head, touching within the center of the head.

*Thorax.* Pronotal epimeral setae the only ones developed; praepectus present but often reduced; mesopraesternum atrophied; meso- and metasterna apparently fused without a suture between them; epimeral suture incomplete, not attaining posterior margins of pronotum.

*Abdomen.* Segment I completely sclerotized without a differentiated pelta, occasionally seemingly fused with segment II dorsally; tube with six long anal setae.

Throughout the species in the subgenera of *Amphibolothrips* the tendency has been toward the reduction of numbers of antennal segments. In *Stephanothrips* it is interesting to note that the fusion of some of the segments may not yet be completed. The species *occidentalis* still retains a partial suture between morphological segments VII and VIII; the species *corticinus* and *fusiantennatus* usually retain a partial suture between morphological segments VI and VII.

A key to the six species that are known to occur in North America follows:

1. Anterior margin of head with three pairs of prominent setae: West Indies, northern Florida, and the Yucatan peninsula.....  
.....*occidentalis* Hood and Williams
- Anterior margin of head with one or two pairs of prominent setae...2
2. With 1 pair of head setae; antennae 4-segmented: Texas.....  
.....*whitcombi* Watson
- With 2 pairs of head setae; antenna 4- or 5-segmented.....3
3. Antenna definitely 5-segmented, with a complete suture dividing morphological segments VI from the combined segments VII and VIII: California, and mountains of Chiapas, Mexico...*bradleyi* Hood
- Antenna definitely only 4-segmented, morphological segment VI at least partially fused to the combined segments VII and VIII.....4
4. Inner pair of prominent anterior head setae long, more than half as long as length of antennal segment III, and pointed at tips: South Carolina ..... *corticinus* Watts
- Inner pair of prominent anterior head setae short, less than half to only about a third as long as length of antennal segment III, pointed or dilated to blunt at tips.....5

5. Maxillary palps large, the distal segment longer than the length of antennal segment II: South Carolina.....*fusiautennatus* Watts  
Maxillary palps short, the distal segment shorter than the length of antennal segment II: North Carolina.....*carolinus* Hood

Subgenus **Trachythrips** Hood

*Trachythrips* Hood (1929:317). Type species by original designation: *Trachythrips watsoni* Hood.

The group of *Amphibolothrips* with no prominent anterior head setae, with six, abnormally four, long anal setae, and with five or six antennal segments.

*Head.* Warty (Fig. 47); eyes with a few large facets arranged in two short rows dorsally; anterior of head without prominent setae; antenna five- or six-segmented, morphological segments III, IV, and V, or IV and V, and VII and VIII fused.

*Mouth parts.* Mouth cones short, broadly rounded; slender maxillary stylets retracted far into the head, positioned far apart within the head, not touching.

*Thorax.* Pronotum usually without any major setae; epimeral suture incomplete, not attaining posterior margins of pronotum; praepectus well developed; mesopraesternum small, degenerate; meso- and metasterna apparently fused without a suture between them.

*Abdomen.* Segment I completely sclerotized without a differentiated pelta (Fig. 108); tube with six long anal setae (Fig. 2).

Some of the American species may be determined by the following key which was based in part on descriptions. Three of the eight North American species were not separated in this key.

1. Antenna 6-segmented, with a distinct suture between morphological segments III and IV.....2  
Antenna 5-segmented, without a distinct suture between morphological segments III and IV.....3
2. Pronotum with a distinct and well-developed pair of epimeral setae; anterior of head bilobed medially: Brazil.....*epimeralis* Hood  
Prothorax lacking major setae; anterior of head rounded: Florida, West Indies, Yucatan peninsula .....*seminole* Hood
3. Anterior of head bilobed, emarginate medially; anterior margin of pronotum with a white crescent blotch: Chiapas and Panama.....  
.....*frontalis* Hood  
Anterior of head broadly rounded; pronotum uniformly dark brown.4





*Antillothrips* new genus

Small, slender, nonreticulate species of the Phlaeothripinae with praepectal plates and with short maxillary stylets, inhabiting grasslands of the Greater Antilles and the Florida Keys.

*Head.* Somewhat elongate, smooth, with slight evidence of a depressed spot on the cheeks behind each eye (Fig. 42); intermediate antennal segments not elongate; postocular setae well developed.

*Mouth parts.* Mouth cones broadly rounded; slender maxillary stylets short, just barely retracted forward of the posterior dorsal head margin.

*Thorax.* Notum with hardly any reticulations or striations; praepectus present though sometimes faint; mesopraesternum fairly well developed; fore wings narrowed in apical half, fringe cilia spaced fairly far apart, without accessory cilia.

*Abdomen.* Pelta small, bell-shaped; tube moderate in length; anal setae not longer than one and one-half times the length of the tube.

Type species. *Antillothrips graminatus* new species.

This new genus differs from most other Tubulifera by the unusual type of maxillary stylets. These stylets, of the slender type, are so short that they hardly retract into that part of the head that is exposed dorsally. Most species in the Tubulifera have longer stylets that retract far into the head. Such short stylets, as in *Antillothrips*, resemble more the kind found in the Terebrantia. Of the Tubulifera known to me, only *Pueblothrips*, *Phthirothrips*, *Sophiothrips*, *Zaxenothrips* and *Williamsiella* have equally short stylets.

In many ways *Antillothrips* resembles those species of *Haplothrips* that formerly were called *Karnyothrips*. It would not be surprising if eventually the species described here may be proved to be already named in *Karnyothrips* or in one of the other subgroups of *Haplothrips*. As in some species of *Haplothrips*, *Antillothrips* has an elongate head, the fore wings are narrowed in the middle, the small fore tarsal tooth protrudes from the region of the unguis, and the wing fringe cilia are widely spaced. The short maxillary stylets are distinctive features of *Antillothrips* and not of *Haplothrips*.

*Pueblothrips*, the closest relative of *Antillothrips*, differs by the absence of praepectal plates, by the shape of the fore wings which are scarcely constricted in the middle, and by the shortness of the head. *Phthirothrips* and *Williamsiella* usually have only seven segments in the antenna, the third antennal segment is either very short or very slender, and the pelta is either wide or divided into three parts. By contrast *Antillothrips* always has eight clearly divided segments in the antenna, the third antennal segment, while not quite as long, is at least about as wide as segment IV, and the pelta is a small single plate.

**Antillothrips graminatus** new species

*Female* (macropterous). Length, distended, exclusive of the antennae, about 1.4 mm. Bicolored brown and yellow. Brown: Head; antennal segment I, most of segment II, and segments VII and VIII; thorax; fore and mid coxae, fore and mid trochanters, fore and most of mid femora; fore wing scale; abdominal segments VIII, IX, and X. Rest of body yellow except antennal segments IV, V, and VI, legs and sides of abdomen somewhat lightly greyed. Red: subintegumental pigments of thorax and area around ocelli. Wings nearly clear.

Head as in Fig. 42; antennal segment VIII barely pedicelate.

Prothorax as in Fig. 42; major setae well developed; hind tibiae with only apical sense hairs developed and these small.

Middle pair of hind dorsal posterior setae of segment IX about as long as tube, and pointed.

*Male*. Unknown.

*Holotype*: Female; Windley's Key, Florida; December 28, 1951 (Richards and Stannard); swept from grasses. *Paratypes*: 7 ♀s; same data as for holotype.

*Additional record*: 1 ♀; Kingston, Jamaica (Hope Gardens); May 6, 1950 (H. B. Mills); from matted grasses.

**Bagnalliella** Karny

*Bagnalliella* Karny (1920:41). Type species by original designation: *Cephalothrips yuccae* Hinds.

In general this group is morphologically like the genus *Haplothrips*. Ecologically, however, *Bagnalliella* is a distinctive segregate. All of the species are confined to *Yucca*, occurring on those plants in colonies on the inner side of the leaf sheaths. Many species of *Bagnalliella*, especially in the forms which lack fully developed wings, have depressed lines or wrinkles on the dorsal surface of the head behind the eyes. In this respect this genus differs markedly from *Haplothrips* but in turn resembles *Podothrips*. *Podothrips* is easily distinguished from *Bagnalliella* by the shape of the praepectal plates and the fore tibiae.

It is interesting to note that *Yucca filamentosa*, the host for the type species of *Bagnalliella*, was originally confined to the east coast of the United States. As European men moved westward they brought with them cultivated eastern *Yucca* and, unintentionally, that plant's thrips. Quite possibly the thrips, *yuccae*, now extends across the continent. The late Mr. Moulton once told me he suspected his species *ryani* might actually be *yuccae*, which, if true, would indicate that *yuccae* has now reached the west coast. Records in the collections of the Illinois Natural History Survey show *yuccae* to occur in gardens as far west as Arkansas.

The other species are known principally from the southwest where species of *Yucca* are also numerous. One western *Bagnalliella* occurs as far east as Sioux City, Iowa (INHS records).

In North America the following eight species have been described.

<i>arizonae</i> Hood (1927f:201).....	Southwestern U.S.A.
<i>australis</i> Hood (1939:568).....	Texas
<i>desertae</i> Hood (1927f:201).....	California
<i>glaucæ</i> Hood (1927e:139).....	Central plains of U.S.A.
<i>huachucae</i> Hood (1927f:200).....	Arizona
<i>mojave</i> Hood (1927f:200).....	California
<i>ryani</i> (Moulton), <i>Haplothrips</i> (1929a:131).....	California
<i>yuccæ</i> (Hinds), <i>Cephalothrips</i> (1902:194).....	East coast of U.S.A., introduced elsewhere, even to Europe.

### **Cephalothrips Uzel**

*Cephalothrips* Uzel (1895:244). Type species by monotypy: *Phloeothrips* [sic] *monilicornis* Reuter.

Smooth thrips usually with eyes extending ventrally, with pedicel of antennal segment VII broad, without praepectal plates, and inhabiting the Holarctic region.

*Head.* Generally smooth, weakly transversely striate; often ventral portion of eyes posteriorly elongated to a point; antenna eight-segmented, segments VII and VIII each with broad pedicels.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets sigmoidal, retracted far into the head, not touching in the center of the head.

*Thorax.* Praepectus absent in at least *monilicornis*; possibly meso-praesternum degenerate.

*Abdomen.* Without unusual adornments; anal setae shorter than the tube in *monilicornis*.

In many ways *Cephalothrips* resembles the genus *Adraneothrips*. Both have a tendency for the ventral portion of the eye to be drawn out to a point posteriorly, both commonly have the bases of the intermediate antennal segments pale in color, and neither has praepectal plates. Possibly these two groups should be placed together under the oldest name, *Cephalothrips*. If, on the other hand, it would be desirable to keep these entities separate, they can be distinguished by the form of the antennae. In species of *Adraneothrips* antennal segment VII bears a slender pedicel; in those of *Cephalothrips* antennal segment VII bears a broad pedicel.

*Cephalothrips* is holarctic in distribution. It could be considered a cool-climate invader derived from the tropical or nearly tropical *Adraneothrips*. The supposition that *Cephalothrips* is more recently evolved is

based on the specialization of certain structures. Each representative of *Cephalothrips* has a more elongated head and the majority of the pronotal setae are more reduced than is the case in most species of *Adraneothrips*.

Two species have been reported to occur in North America. They may be distinguished as follows:

Eyes prolonged ventrally; Europe, and British Columbia to New York; possibly introduced to the New World. . . . . *monilicornis* Reuter  
 Eyes not prolonged ventrally; California. . . . . *hesperus* (Moulton)

I have studied a limited number of specimens of *monilicornis* from Czechoslovakia. The assignment of *hesperus*, based on a single female, to *Cephalothrips* was made by Hood in 1941.

### Chamaeothrips Hood

*Chamaeothrips* Hood (1954a:44). Type species by original designation: *Chamaeothrips jucundus* Hood.

Bulge-eyed members of the Phlaeothripinae, with each antenna seven-segmented, with all major prothoracic setae minute, and with a long hexagonally reticulate tube.

*Head.* Longer than wide, entirely covered by hexagonal reticulations; cheeks incut behind the eyes; postocular setae minute to possibly absent; each antenna seven-segmented, without a trace of a suture between morphological segments VII and VIII, segments III and IV with some dorsal setae blunt to dilated at tips.

*Mouth parts.* Mouth cones short, broadly rounded; maxillary stylets slender, placed far apart to forming a V within head.

*Thorax.* Prothoracic setae including epimeral setae minute; praepectus present but small; mesopraesternum well developed; fore wings without accessory fringe cilia.

*Abdomen.* Entirely covered, including tube, with strong hexagonal reticulations; pelta broad, rectangular; slender tube much longer than the head length.

This genus differs from *Orthothrips* in the characteristically lesser number of antennal segments, and by the heavily sculptured tube. Only the species *decoratus* Stannard (1955a) occurs in North America. Dr. Bonet found it in Veracruz, Mexico.

### Chirothripoides Bagnall

*Chirothripoides* Bagnall (1915b:505). Type species by original designation: *Chirothripoides typicus* Bagnall.

Thrips with several posterior finger-like projections arising from abdominal sternite VIII.



This genus has been variously placed, near *Plectrothrips* by Hood or near *Preeriella* and *Hydiorhrips* by Bagnall. After having seen the unique type and other specimens of *typicus*, and after discussing the matter with Dr. Bagnall, I prefer to regard *Chiorhripoides* as a specialized derivative of *Preeriella* and *Hydiorhrips*. In over-all appearance *Chiorhripoides* resembles *Preeriella*, *Smicrothrips*, and *Hydiorhrips* so closely that almost certainly these four arose from a common ancestor. It is especially significant that in all members of these genera, except perhaps in *Smicrothrips* which I have not seen, each tarsus is reduced to one segment. By contrast, all species of *Plectrothrips* have each mid and hind tarsus two-segmented.

*Chiorhripoides* can be considered specialized by degeneration in many respects. In the type species, at least, the major pronotal sclerite, the pelta, and abdominal tergite II are reduced. The edges of these sclerites are fragmented into tiny platelets. Apparently, the praepectus has completely disappeared.

One species, *Chiorhripoides dendropogonus* Watts, occurs in North America. It was found once, in South Carolina.

### Craniothrips Bagnall

*Craniothrips* Bagnall (1915b:504). Type species by original designation: *Craniothrips urichi* Bagnall.

Slender, yellow Tubulifera with head elongate, with slender maxillary palps, and with the midlateral prothoracic setae placed close to the anterolateral prothoracic setae.

*Head.* Elongate, slightly arched, about twice as long as wide (Fig. 50); antenna eight-segmented, segment II with dorsal sensorium placed near the apex, segment III not elongate, subequal to the length of segment II and to the length of segment IV; postocular setae stout, blunt to slightly dilated at tips, placed as in Fig. 50.

*Mouth parts.* Mouth cones broadly rounded; slender maxillary stylets retracted halfway into the head, placed far apart.

*Thorax.* Major setae of prothorax stout, blunt to slightly dilated at tips, midlateral setae close to anterolateral setae (Fig. 50); presence or absence of praepectal plates and form of mesopraesternum unknown; fore femora enlarged; fore wings slender with fringe cilia widely spaced.

*Abdomen.* Shape of pelta unknown; major setae stout and blunt to dilated at tips; tube moderate in size.

As Bagnall (1915b) suggested, this genus may be a derivative of *Haplothrips*. It can be distinguished from all other Tubulifera with slender maxillary stylets by the unusual position of the midlateral prothoracic setae which are placed close to the anterolateral setae.

So far, *Craniothrips* has not been reported from North America proper but may be expected. The only known species occurs on Trinidad and is found on leaves of *Inga*.

### **Docessissophothrips Bagnall**

*Docessissophothrips* Bagnall (1908:21). Type species by original designation: *Docessissophothrips ampliceps* Bagnall.

*Tropothrips* Hood (1949:70). Type species by original designation: *Tropothrips borgmeieri* Hood. Synonymized by Stannard (1956a).

*Maxillata* Faure (1949b:852). Type species by original designation: *Maxillata priesneri* Faure. Synonymized by Stannard (1956a).

Thrips with long maxillary stylets which are looped at least several times within the head and mouth cones.

These tubuliferans are essentially like members of *Polyphemothrips* except for the form of the head, which is more swollen, and in the length of the maxillary stylets. The number of loops made by the coiling of the long maxillary stylets within the head is the only good key characteristic so far discovered to distinguish *Docessissophothrips* from *Polyphemothrips*, in particular, *P. tibialis*. In *Polyphemothrips tibialis* the maxillary stylets are shorter and make but one loop when at rest within the head. By contrast, in species of *Docessissophothrips* there is always more than one loop of the stylets within the head.

Apparently the populations of this genus are confined to the subtropical or tropical regions. I have seen the types of all four species known from North America. In addition I have seen an undescribed species in the Priesner collection which had been found in Guadeloupe.

<i>ampliceps</i> Bagnall (1908:202).....	Orizaba, Mexico
<i>dampfi</i> Priesner (1933a:59).....	Cordoba, Mexico
<i>nigripes</i> (Stannard), <i>Tropothrips</i> (1954a:84).....	Costa Rica
<i>richardsi</i> (Stannard), <i>Tropothrips</i> (1954a:82).....	Florida

### **Erkosothrips Stannard**

*Erkosothrips* Stannard (1955a:81). Type species by original designation: *Erkosothrips interior* Stannard.

Reticulate-headed members of the Phlaeothripinae, with moderate-sized, nonreticulate tube, with each antennae eight-segmented, and with prothoracic anteromarginal setae minute.

*Head*. Longer than wide, entirely covered by hexagonal reticulations; cheeks incut behind eyes; postocular setae short; each antenna eight-segmented, segments III and IV with several knobbed setae.

*Mouth parts*. Mouth cones short, broadly rounded; maxillary stylets slender, placed far apart within head.

*Thorax*. Most major prothoracic setae well developed except antero-

marginal setae which are minute; epimeral sutures sometimes complete but more often incomplete; praepectus present; mesopraesternum well developed; fore wings when present, without accessory fringe cilia.

*Abdomen.* Pelta elongate oval to rectangular; tube moderate in size, without strong reticulations.

This genus is the North American equivalent of the Sumatran genus *Sagenothrips*. Unlike *Sagenothrips* and the related African *Porcothrips*, *Erkosothrips* characteristically has the antennal setae on segments III and IV dilated at the tips.

In my recent treatment of this genus (Stannard 1955a), I included the following North American species.

claviger (Hood), Eurythrips (1941:166).....	Northeastern U.S.A.
floridensis Stannard (1955a:84).....	Florida
interior Stannard (1955a:84).....	Illinois, Michigan
reticulatus (Watson), Glyptothrips (1935:45).....	Florida
sculpturus (Hood), Eurythrips (1936a:5).....	Southeastern U.S.A.
silvarum (Hood), Eurythrips (1941:163).....	Northeastern U.S.A.

### Eschatothrips Stannard

*Eschatothrips* Stannard (1955a:88). Type species by original designation:  
*Eurythrips reticulotubus* Stannard.

Reticulate-headed thrips belonging to the Phlaeothripinae with tube hexagonally reticulate, with eight segments in each antenna and with prothoracic anteromarginal setae minute.

*Head.* Longer than wide, entirely covered by hexagonal reticulations; cheeks incut behind eyes; postocular setae short; each antenna eight-segmented, segments III and IV with several knobbed setae.

*Mouth parts.* Mouth cones short, broadly rounded; maxillary stylets slender, placed far apart within the head.

*Thorax.* Most major prothoracic setae well developed, except antero-marginal setae which are minute; epimeral sutures complete; praepectus present; mesopraesternum well developed; fore wings without accessory fringe cilia.

*Abdomen.* Surfaces, including tube, covered by hexagonal reticulations; pelta rectangular; tube moderate in size, somewhat stout.

The species of this genus may be distinguished from those in the near-related *Erkosothrips* by the presence or absence of reticulations on the tube. *Erkosothrips* lacks reticulations on the tube, whereas in *Eschatothrips* the tube is strongly reticulate. *Glyptothrips* is also closely related, but it differs in having only seven segments in each antennae in contrast to the eight segments found in *Eschatothrips*.



As far as is known, only two species inhabit North America. Others occur in South America.

barythripoides (Watson), Glyptothrips (1935:55) . . . . . Southeastern U.S.A.  
reticulotubus (Stannard), Eurythrips (1953:2) . . . . . Jamaica

### Eurythrips Hinds

*Eurythrips* Hinds (1902:202). Type species by original designation: *Eurythrips ampliventralis* Hinds.

Keg-eyed thrips of the Phlaeothripinae with head not completely reticulate, with cheeks usually incut behind eyes, with praepectal plates; with well-developed postocular setae, and with short to moderate-sized tubes.

*Head.* Dorsal surface not entirely covered by hexagonal reticulations; cheeks usually incut behind eyes; postocular setae well developed; each antenna eight-segmented, antennal setae usually pointed at tips.

*Mouth parts.* Mouth cones broadly rounded; slender maxillary stylets spaced apart within head.

*Thorax.* Most major prothoracic setae well developed, except antero-marginal setae which are minute; epimeral sutures usually incomplete; praepectus always present; fore wings without accessory fringe cilia.

*Abdomen.* Pelta moderately broad to bell-shaped (Figs. 128, 129); tube moderate in size, never strongly reticulate.

*Eurythrips* is closely related to *Terthrothrips*; the former is predominantly a North American group whereas the latter is more common in South America. Until the species in each of these genera can be monographed it is difficult to know where to draw the line between them. At present I follow Hood (1935b) and use the total length of the antenna as the criterion for the separation of the species. Those which have each antenna shorter than two and a half times the length of the head can be assigned to *Eurythrips*. Those with each antenna longer than two and a half times the head length can be placed in *Terthrothrips*.

The following species from North America belong in *Eurythrips* according to the literature and, in part, according to my interpretations.

ampliventralis Hinds (1902:202) . . . . . Eastern U.S.A.  
batesi (Watson), Glyptothrips (1935:56) . . . . . Southeastern U.S.A.  
citricollis Hood (1941:240) . . . . . Florida  
conjunctus Hood (1934a:63) . . . . . Panama  
connatus Hood (1938c:378) . . . . . Florida  
cornutus Moulton (1929d:63) . . . . . Cuba  
disjunctus Hood (1941:153) . . . . . Eastern U.S.A.  
dissimilis Hood (1938e:365) . . . . . Florida  
eddeyi (Watson), Glyptothrips (1935:57) . . . . . Southeastern U.S.A.  
forticornis Hood (1939:593) . . . . . Alabama

<i>fuscipennis</i> Moulton (1929d:65).....	Cuba
<i>harti</i> Hood (1925c:135).....	Texas
<i>hindsii</i> Morgan (1913:27).....	Tennessee
<i>hookae</i> Hood (1933c:414).....	Panama
<i>longilabris</i> Watson (1921a:36).....	Florida
<i>macrops</i> Hood (1925e:219).....	Florida
<i>osborni</i> Hinds (1902:203).....	Eastern U.S.A.
<i>pettiti</i> Hood (1941:203).....	Eastern U.S.A.
<i>robustisetis</i> Watson and Preer (1939:3).....	Florida
<i>tarsalis</i> Hood (1925e:220).....	Eastern U.S.A.
<i>montanus</i> (Watson), <i>Plectrothrips</i> (1933b:16). New synonymy	
<i>tristis</i> Hood (1941:157).....	New York
<i>umbrisetis</i> Hood (1933c:415).....	Panama
<i>varius</i> Moulton (1929d:64).....	Cuba
<i>virginianus</i> Hood (1952a:77).....	Virginia, Connecticut
<i>watsoni</i> Hood (1941:161).....	Florida

### **Eupathithrips Bagnall**

*Eupathithrips* Bagnall (1908:23). Type species by original designation: *Eupathithrips dentipes* Bagnall.

*Heterothrips* Buffa (1908:124). Type species by monotypy: *Heterothrips silvestrii* Buffa. Preoccupied by *Heterothrips* Hood (1908a).

*Polyommatothrips* Buffa (1909b:164). New name for *Heterothrips* Buffa. Synonymized by Bagnall (1915b).

Large-eyed, warty-cheeked Tubulifera with small decumbent spines on the pelta.

*Head.* Elongate; cheeks with a series of enlarged, seta-bearing warts; eyes greatly enlarged, bean-shaped, nearly touching on the dorsum at the anterior and posterior angles (Fig. 74); antennae inserted under the head; intermediate antennal segments vasiform; sense cones extremely long.

*Mouth parts.* Mouth cones long, pointed; slender maxillary stylets retracted far into the head, touching in the center of the head.

*Thorax.* Praepectus absent; mesopraesternum well developed; metanotum strongly hexagonally reticulate; fore wings broad, fringe cilia placed close together; fore femur armed on the inner side.

*Abdomen.* Pelta small, triangular, with several decumbent spines near the base (Fig. 136); tube moderately long; with occasional white spots at the sides of several segments.

*Larvae.* Head horns well developed in at least instar II.

Proceeding from *Acanthothrips nodicornis* with its large but well-separated eyes, to *Aca. itzanus* in which the eyes are closer together, to species of *Eupathithrips* in which the eyes are very closely spaced, it is logical to assume that *Eupathithrips* was derived from *Acanthothrips* stock. Such a conclusion is further substantiated by the discovery of a

larva of *Eupathithrips* which has well-developed head horns just as in many species of *Acanthothrips*, Hood (1934a). The vase-shaped intermediate antennal segments with long sense cones, the long pointed mouth cones, the heavily warted cheeks, the white spots on the abdomen, and the armed fore femora of *Eupathithrips* show additional similarities with *Acanthothrips*.

Although the only distinct differences so far found between *Eupathithrips* and *Acanthothrips* are in the placement of the eyes on the dorsum of the head, the ventral or anterior origin of the antennae, and the presence or absence of small spines on the pelta, *Eupathithrips* may be considered a separate genus for it is doubtful that there ever could be any confusion in segregating the two entities.

It is interesting to note that several of the abdominal segments bear six wing-holding setae, a condition found in *Acanthothrips itzanus*, *Holopothrips*, and in species of *Neurothrips*.

Three species occur in Central America. The rest are known from South America including Trinidad.

bagnalli Morgan (1929:3).....	Honduras
denticeps Bagnall (1908:203).....	Guatemala
spectator Hood (1934a:73).....	Panama

### Gigantothrips Zimmermann

*Gigantothrips* Zimmermann (1900:18). Type species by monotypy: *Gigantothrips elegans* Zimmermann.

*Panurothrips* Bagnall (1908:28). Type species by original designation: *Panurothrips gracilis* Bagnall. Synonymized by Bagnall (1916).

Large, long-tubed genus of the Phlaeothripinae, with large eyes positioned fairly close together, with fore ocellus borne on a prominent raised hump, and with pelta medium in size and triangular in shape.

*Head*. Elongate; eyes large, positioned fairly close together; fore ocellus borne on prominent hump which projects forward much beyond the eye margins; postocular setae minute; intermediate antennal segments extremely long.

*Mouth parts*. Mouth cones somewhat long and broadly rounded; slender maxillary stylets retracted halfway into the head, nearly touching along the center line.

*Thorax*. Notal markings intermediate between striae and hexagonal reticulations; praepectus absent; mesopraesternum well developed?; fore wings broad, not constricted in the middle.

*Abdomen*. Pelta small to moderate in size, triangular; apical segments elongate; tube long, often hairy and slightly bowed.

These giant thrips are obviously related to *Gynaikothrips*, *Cercothrips*,

and *Holopothrips*. In fact these four genera seem to grade into each other when the world fauna is considered. Their taxonomic separations are far from satisfactory.

Like *Gynaikothrips*, some species of *Gigantothrips* produce galls. From *Gynaikothrips* and *Holopothrips*, *Gigantothrips* of North America may be distinguished by the long intermediate antennal segments and by the long, slightly bowed tube.

By their size, long tube, and lengthened antennae, typical species of *Gigantothrips* resemble several genera in the subfamily Megathripinae. These resemblances are the result of convergent evolution because *Gigantothrips* is a member of the Phlaeothripinae.

In the world there are about twenty species, or at least about that many names. Only one species, *Gigantothrips rossi* Moulton, occurs in North America; it is found in Mexico. The other species inhabit the Ethiopian and Oriental regions, including some of the Pacific Islands.

### **Gnophothrips Hood and Williams**

*Gnophothrips* Hood and Williams (1915:145). Type species by original designation: *Gnophothrips megaceps* Hood and Williams.

This genus is similar to *Liothrips*, especially to the complex containing species that were formerly assigned to *Rhynchothrips*. The species *piniphilus*, the only known species with fully developed wings, differs from winged members of *Liothrips* by the absence of accessory fringe cilia on the fore wings. Furthermore in the species of *Gnophothrips* the head is proportionately longer than in any species of *Liothrips*.

I am indebted to Miss Kellie O'Neill for pointing out the distinctive characteristic of the fore wings of this genus and for her discovery that in the brachypterous forms of *piniphilus*, at least, the wing stubs are usually twice as long as in any species of *Rhynchothrips* which is considered herein to be a part of *Liothrips*.

The following two species are known; the species *piniphilus* feeds on pine and occasionally causes damage to pine plantations.

*megaceps* Hood and Williams (1915:133) . . . . . Florida  
*piniphilus* Crawford, J. C. (1938:39) . . . . . New York, Ontario

### **Goniothrips Hood**

*Goniothrips* Hood (1927f:202). Type species by original designation: *Goniothrips denticornis* Hood.

This genus differs but slightly from the main bulk of the species in *Haplothrips*. Its structural difference is in the form of antennal segment III which is drawn out and pointed much as in the terebrantian genera *Chirothrips* and *Limothrips* (Fig. 11). Although there is only this one distinction, it is one that will permit positive recognition.



The males lack the differentiated glandular area so often found on abdominal sternite VIII in *Phlaeothrips*-like species.

*Chiridothrips* Ramakrishna Ayyar and Margabandhu, which may or may not be a relative of *Goniothrips*, also has a produced antennal segment. In *Chiridothrips* segment II, instead of segment III, is pointed at the apex. When specimens can be obtained, a comparison of other features of these two genera would be worth while, for a more nearly exact determination of their relationships.

Only one species, *denticornis*, is known in the genus *Goniothrips*. It occurs on the western plains of the United States.

### *Gynaikothrips* Karny

*Gynaikothrips* Zimmermann (1900:13). Misstatement for *Mesothrips* Zimmermann.

*Gynaikothrips* Karny (1911b:559). Type species by original designation: *Mesothrips uzeli* Zimmermann.

*Parateuchothrips* Moulton (1944:279). Type species by original designation: *Parateuchothrips fuscus* Moulton. Questionably synonymized by Priesner (1949).

Moderately large thrips with fairly large eyes, broadly rounded mouth cones, intermediate antennal segments only slightly lengthened, irregularly twisted pronotal striae, and tube somewhat long.

*Head*. Elongate; eyes fairly large; ocellar area raised, hexagonally reticulate; intermediate antennal segments slightly lengthened; post-ocular setae large or small but never minute.

*Mouth parts*. Mouth cones broadly rounded; slender maxillary stylets retracted halfway into the head, spaced far apart within the center of the head.

*Thorax*. Pronotal striae arranged in an irregular, twisted manner in the North American species; epimeral sutures often incomplete, not reaching posterior margins of pronotum; praepectus absent; mesoprae-sternum well developed, large; metanotal markings intermediate between longitudinal striae and hexagonal reticulations; fore wings broad, not indented in the middle.

*Abdomen*. Pelta usually triangular, occasionally with two additional lateral plates (Fig. 120); tube moderately long.

Most workers credit *Gynaikothrips* to Zimmermann. Actually Zimmermann did first introduce this name but only as a misstatement for *Mesothrips*. *Gynaikothrips* appeared as a substitute for *Mesothrips uzeli* in the caption of Zimmermann's Fig. 4, although Fig. 5 was labeled *Mesothrips uzeli*, as also was the title of his discussion. Subsequently Karny gave the first diagnosis of *Gynaikothrips* and he, not Zimmermann, becomes the author. Clearly this case is similar to *Pactothrips* versus

*Glyptothrips*. *Pactothrips* which appeared under *Glyptothrips* generally is considered a misstatement for *Glyptothrips* and has no nomenclatorial standing.

If Moulton (1933b) was correct in his assumption that *Smerinthothrips* and *Gynaikothrips* are synonymous, then *Smerinthothrips* has priority. Schmutz published *Smerinthothrips* in 1909, two years before Karny validated *Gynaikothrips*. I prefer to retain *Gynaikothrips* until I can study *Smerinthothrips*.

*Gynaikothrips* has been related to many genera from *Megalothrips* to *Liothrips*. Even as late as 1945, Jose del Cañizo believed that this genus was phylogenetically related to *Cryptothrips* among others. More reasonably, *Gynaikothrips* should be placed near the *Liothrips* and *Hoplandrothrips*. These genera resemble *Gynaikothrips* in many details and all belong to the subfamily Phlaeothripinae. *Cryptothrips* belongs to the Megathripinae and is far distant in relationship to *Gynaikothrips*. The closest relatives of *Gynaikothrips* are *Gigantothrips* and *Holopothrips* and other genera restricted to the Oriental regions such as *Mesothrips*, *Eugynothrips*, etc.

To conform with tradition, I have retained *Gynaikothrips* as a full genus. The characteristic of the twisted pronotal striae permits the positive recognition of the species in North America, the faunal region to which I have limited myself at the present time.

The broadly rounded mouth cone comprises a diagnostic characteristic described by Karny (1912) and Bagnall (1928). This characteristic helps separate *Gynaikothrips* from *Liothrips*.

Species of this genus often make galls and frequently they are partial to fig leaves. In 1939 Priesner gave a key to the then known species.

Although I have listed five species for North America, perhaps only one of them is a true species of *Gynaikothrips*. If so, North America was devoid of this genus before the introduction of *ficorum*. According to Wolcott (1953) and others, *uzeli* and *ficorum* may have been used in North America as names for the same species. Most definitely Moulton's record in 1929 of the occurrence of a species out-of-doors in Illinois should be considered erroneous. Miss Blevins who is credited with the discovery of this *Gynaikothrips* did collect thrips near Atwater, Illinois, but it is doubtful that the *Gynaikothrips* could have come from that locality. She told me once that she also collected thrips from greenhouses in Urbana from whence the specimens of this genus may have been taken.

Before his death, Mr. Moulton informed me that he considered his species *elongatus* and *ferrisi* as members of the genus *Gynaikothrips*. Without knowledge of either species, I have followed his suggestion and placed them in this genus.



- elongatus (Moulton), Holopothrips (1929b:14)..... Mexico  
 ferrisi (Moulton), Holopothrips (1929b:13)..... Mexico  
 ficorum (Marchal), Phloeothrips [*sic*] (1908:252)..... Pantropical  
     *bakeri* (Crawford, D. L.), Liothrips (1910:161)  
 (?) sulcifrons Hood (1936c:259)..... Panama  
 uzeli (Zimmermann), Mesothrips (1900:12)..... Pantropical?

### Glyptothrips Hood

*Glyptothrips* Hood (1912e:116). Type species by original designation: *Glyptothrips flavescens* Hood.

*Pactothrips* Hood (1912e:116). Misstatement for *Glyptothrips*.

Reticulate-headed thrips of the Phlaeothripinae with each antenna seven-segmented, with a nonreticulate tube, and with the prothoracic anteromarginal setae minute or lacking.

This genus is essentially like *Eschatothrips*, except that in *Glyptothrips* the moderate-sized tube is not hexagonally reticulate, and in *Glyptothrips* each antenna is seven-segmented, or at most with but a partial suture between morphological segments VII and VIII.

Only the northeastern U.S.A. species, *flavescens*, occurs in North America.

### Haplothrips Amyot and Serville

*Haplothrips* Amyot and Serville (1843:640). Type species by monotypy:

*Phloeothrips* [*sic*] *albipennis* Burmeister (= *Thrips aculeata* Fabricius).

*Anthothrips* Uzel (1895:237). Type species by subsequent designation of Priesner (1949): *Thrips aculeata* Fabricius. Synonymized by Karny (1911b, 1912) and Bagnall (1912).

*Zygothrips* Uzel (1895:243). Type species by monotypy: *Zygothrips minuta* Uzel. Synonymized by Priesner (1949).

*Anthemothrips* Karny (1907:51). Type species by monotypy: *Anthemothrips reuteri* Karny. Synonymized by Priesner (1949).

*Leptothrips* Hood (1909b:249). Type species by original designation: *Cryptothrips aspersus* Hinds (= *Phloeothrips* [*sic*] *mali* Fitch). New synonymy.

*Neoheegeria* Schmutz (1909b:344). Type species by monotypy: *Neoheegeria dalmatica* Schmutz. New synonymy.

*Hindsiana* Karny (1910:51). Type species by monotypy: *Hindsiana flavicincta* Karny. Synonymized by Priesner (1949).

*Porphyrothrips* Vuillet (1913:78). Type species by original designation: *Porphyrothrips cottei* Vuillet. Synonymized by Priesner (1949).

*Anthirothrips* Watson and Osborn (1919:117). Misspelling for *Anthothrips* Uzel.

*Dolichothrips* Watson (1920b:21). Type species by original designation: *Cephalothrips elongata* Watson. Preoccupied by *Dolichothrips* Karny. New synonymy.

*Karynia* Watson (1922a:6). Type species by original designation: *Karynia weigeli* Watson (= *Anthothrips flavipes* Jones). Misspelling for *Karnyia*, preoccupied by *Karnyia* Shelford. New synonymy.

*Karnyothrips* Watson (1923:23). New name for *Karnyia* Watson.

*Watsoniella* Karny (1923:376). New name for *Dolichothrips* Watson. Preoccupied by *Watsoniella* Berg.

*Haplothrips* subgenus *Xylaplothrips* Priesner (1928a:572). Type species by monotypy: *Cryptothrips fuliginosus* Schille. New synonymy.

*Haplothrips* Bagnall (1934:495). Type species by original designation: *Haplothrips globiceps* Bagnall. Synonymized by Priesner (1949).

Medium-sized thrips with no especially developed peculiarities, usually with a well-developed, wide maxillary bridge, ordinarily with praepectal plates, usually with the fore wings constricted in the middle, and often with the third antennal segment somewhat small in size. Some of the species are known to be predaceous; many others also might have that same habit. They can be found on living foliage, in flowers, under bark, or in leaf litter.

*Head.* Weakly striate or smooth (Fig. 52); eyes moderate in size, sometimes considerably prolonged posteriorly on the ventral surface; antenna eight-segmented, segment III sometimes small, segment VIII often broadly attached to segment VII.

*Mouth parts.* Mouth cones broadly rounded to pointed; maxillary stylets thin, usually positioned far apart within the head; maxillary bridge ordinarily wide.

*Thorax.* Midlateral setae of prothorax occasionally minute; praepectus usually present; mesopraesternum somewhat degenerate; fore wings, when present, usually but not always constricted in the middle, with or without accessory fringe cilia.

*Abdomen.* Pelta generally small, generally triangular in winged forms (Fig. 118); length of anal setae variable, sometimes longer than twice the length of the tube; males often with a differentiated glandular area on abdominal sternite VIII.

*Karnyothrips* (= *Watsoniella*, preoccupied) is considered here as an outright synonym of *Haplothrips*. The species formerly assigned to this group are definitely *Haplothrips*-like although they are not as robust and are somewhat degenerate in form. They might be segregated as a complex of *Haplothrips* but it is not appropriate to give them generic rank because they exhibit no outstanding distinctive characteristics.

Attempts to separate *Karnyothrips* from *Haplothrips* have been made in the past. Hood (1927c) suggested that *Karnyothrips* may be known in both sexes "by the enlarged tooth, claw-like and somewhat forwardly directed, which arises from the inner distal angle of the first tarsal segment . . ." and by several other minor points that have since proved to be unreliable. In 1939 Hood described *Karnyothrips dimidiatus* (transferred to *Agrothrips* in this paper) whose fore tarsus did not have a forward tooth at the apex but instead had "a minute tooth on [the] inner surface beyond [the] middle" and in the same paper he described

*Karnyothrips anthracinus* which had no fore tarsal tooth at all. The same author in 1949 gave a reminder that he had pointed out the diagnostic characters for *Karnyothrips* in 1927. This reference, mentioned above, was to the apical, forwardly directed, fore tarsal tooth, among other points. Nevertheless, at the same time, Hood brought into *Karnyothrips* his species *longiceps* which does not have a forwardly directed apical tooth on the fore tarsus but rather has a tooth similar to typical species of *Haplothrips*. Most certainly, *Karnyothrips* has not been distinguished satisfactorily from *Haplothrips* in the literature.

*Xylaplothrips* was first considered a subgenus of *Haplothrips*, and later it was raised to full generic rank. Priesner (1939a) believed that it could be separated from *Karnyothrips*, at least, by the size of the fore femora. Such a trivial characteristic has little meaning when all the species are considered. It is true that in general those species assigned to *Xylaplothrips* have the fore femora normally shaped, and most species grouped under *Karnyothrips* have the fore femora enlarged. However, since some species of *Karnyothrips* such as *franciscanus* and *nigriflavus* have the fore femora only "very slightly enlarged" (Hood 1949), this characteristic becomes most difficult to use in a practical way. In my opinion those species previously included in *Xylaplothrips* should be grouped as another complex under *Haplothrips*.

*Leptothrips* cannot be maintained as a full genus. As do the classical species of *Haplothrips*, those species assigned to *Leptothrips* always have midlateral prothoracic setae despite the denial of this fact by other students (Hood 1927c). In most instances these setae are small, as they are in some other *Haplothrips*. Furthermore, there are, especially in the southwestern United States, species which are intermediate, in the shape of the head and in the type of metanotal striations, between extreme forms of so-called *Leptothrips* and *Haplothrips*. At best, *Leptothrips* might be set up as a subgenus, although at present I know of no points that could be used to provide positive criteria for their separation.

With or without the inclusion of *Karnyothrips*, *Xylaplothrips*, and *Leptothrips*, *Haplothrips* cannot be defined easily. It is generally stated that all species of this group have the fore wings, when present, constricted in the middle. Such a characterization is a trend point and not an absolute criterion. In several species there is almost no evidence of constriction in the wings and in two species, *dodgei* and *rectipennis*, the wings are actually less constricted than the wings in certain species of the genus *Hoplandrothrips*, a group which by some reports—although incorrect—is not supposed to have the fore wings constricted. Because *Haplothrips* is so difficult to define it is considered here to be a "super" genus.

In North America there are many species. Their taxonomy is badly in need of revision.

- acaciae* (Hood), *Leptothrips* (1938f:211) ..... Arizona  
*aculeatus* (Fabricius), *Thrips* (1803:312) ..... Iowa  
*americanus* (Hood), *Zygothrips* (1912e:114) ..... Eastern U.S.A.  
*angustipennis* Watson (1922c:38) ..... Georgia, Florida  
*anthracinus* (Hood), *Watsoniella* (1939:574) ..... Texas  
*arizona* (Hood), *Karnyothrips* (1938f:214) ..... Arizona  
*brimleyi* (Hood), *Karnyothrips* (1938d:231) ..... North Carolina, Florida  
*californicus* Mason (1926:156) ..... California  
*catchingsi* (Watson), *Hindsiana* (1923:80) ..... Louisiana  
*citri* (Watson), *Cryptothrips* (1918:73) ..... Florida  
*distalis* Hood (1925c:103) ..... Arizona, California  
*dodgei* (Hood), *Hindsiana* (1925a:26) ..... New York  
*elegans* (Moulton), *Cephalothrips* (1929c:236) ..... Tennessee  
*fasciculatus* (Crawford, D. L.), *Phyllothrips* (1909a:105) ..... California  
*fasciculatus* var. *stenoceps* (Crawford, D. L.),  
*Phyllothrips* (1909a:108)  
*nigricornis* (Jones), *Anthothrips* (1912:17)  
*jonesii* Karny (1912:344)  
*russelli* (Morgan), *Leptothrips* (1913:39)  
*faurei* Hood (1914d:157) ..... New York, Iowa  
*festivus* (Hood), *Watsoniella* (1939:571) ..... Texas  
*funki* Watson (1920b:23) ..... Florida  
*gaviotae* Moulton (1929a:132) ..... California  
*gowdeyi* (Franklin), *Anthothrips* (1908:724) ..... Cosmopolitan  
*dozeri* (Watson), *Anthothrips* (1918:71)  
*mahensis* Bagnall (1921:267)  
*soror* Schmutz (1913:1039)  
*variabilis* (Crawford, D. L.), *Anthothrips* (1910:166)  
*gracilis* Watson (1920b:18) ..... Florida  
*graminis* Hood (1912b:69) ..... Eastern U.S.A., Mexico  
*floridensis* (Watson), *Zygothrips* (1922b:21)  
*querci* Watson (1920b:28)  
*rabuni* Watson (1922c:37)  
*halophilus* Hood (1915a:29) ..... Utah  
*harti* (Hood), *Zygothrips* (1913a:162) ..... Eastern U.S.A.  
*femoralis* (Morgan), *Zygothrips* (1913:40)  
*heliomanes* (Hood), *Leptothrips* (1927f:202) ..... California  
*humilis* Hood (1914d:158) ..... Panama, Florida  
*jonesianus* (Cott), *Watsoniella* (1950:187) ..... Cosmopolitan  
*flavipes* (Jones), *Anthothrips* (1912:18)  
*salicis* (Jones), *Cryptothrips* (1912:20)  
*harnedi* Watson (1923:45)  
*oneco* Watson (1923:168)  
*venustus* (Moulton), *Cephalothrips* (1941:319)  
*weigeli* (Watson), *Karnyia* (1922a:7)  
*pullus* (Hood and Williams), *Zygothrips* (1915:127)  
*larreae* (Hood), *Leptothrips* (1938f:207) ..... California, Arizona



- leucanthemi (Schrank), Thrips (1781:298).....Introduced into N.A.  
from Europe
- statices* (Heeger), Phloeothrips [*sic*] (1852:128)  
*niger* (Osborn), Phloeothrips [*sic*] (1883:154)  
*armata* (Lindeman), Phloeothrips [*sic*] (1887:335)  
*statices* var. *trifolii* Priesner (1919b:130)  
*wyomingensis* (Watson), Zygothrips (1923:82)  
longiceps (Hood), Zygothrips (1908a:364).....U.S.A.  
*errans* (Moulton), Cephalothrips (1911:43)  
mali (Fitch), Phloeothrips [*sic*] (1855:806).....U.S.A.  
*adironacks* (Watson), Cryptothrips (1921b:83)  
*asperus* (Hinds), Cryptothrips (1902:205)  
*asperus macro-ocellatus* (Watson), Leptothrips  
(1913:148)  
*californicus* (Daniel), Criptothrips [*sic*] (1904:293)  
*cassiae* Watson (1920b:23)  
*mcconnelli* Crawford, D. L. (1910:163)  
malifloris Hood (1916b:121).....New Mexico  
melaleucus (Bagnall), Hindsiana (1911:61).....Cosmopolitan  
*cocois* (Watson), Hindsiana (1922e:66)  
*bicolor* (Hood and Williams), Zygothrips (1915:126)  
*elongatus* (Watson), Cephalothrips (1919b:3)  
*pini* (Watson), Hindsiana (1922d:65)  
merrilli Watson (1920a:7).....Florida, Cuba  
noveboracensis (Hood), Watsoniella (1940a:566)....New York  
nubilipennis Hood (1914d:156).....Michigan  
ochropezus (Hood), Karnyothrips (1934a:71).....Panama  
oregonensis (Hood), Leptothrips (1938f:213).....Oregon  
oribates (Hood), Leptothrips (1938f:205).....Southwestern U.S.A.  
pini (Watson), Cryptothrips (1915:49).....Florida  
preeri Hood (1939:365).....Texas  
pullatus (Hood), Hindsiana (1925a:27).....New York  
purpuratus Hood (1925c:101).....Arizona  
rectipennis Hood (1927d:112).....District of Columbia  
rhopalocerus (Hood), Hindsiana (1925b:57).....Guadeloupe  
ruber (Moulton), Trichothrips (1911:42).....California  
shackelfordi Moulton (1927:197).....Illinois  
sonorensis Stannard (1956b:25).....California, Idaho, New  
Mexico  
speciosus (Hood), Zygothrips (1925b:56).....St. Croix  
texensis (Hood), Watsoniella (1940a:569).....Texas  
verbasci (Osborn), Phloeothrips [*sic*] (1896:228)....Introduced to N.A.  
from Europe
- femoralis* (Moulton), Trichothrips (1907:61)  
xanthocrepis Hood (1940a:564).....New York

### Holopothrips Hood

*Holopothrips* Hood (1914c:49). Type species by original designation: *Holopothrips signatus* Hood.

Medium-sized dark brown thrips with large, closely spaced eyes, rounded mouth cones, faint pronotal striations, and a moderate-sized tube.

*Head.* Somewhat to considerably elongate; eyes large, sometimes extremely close together but not touching on the meson of the dorsum (Fig. 65); ocellar area slightly raised but not produced forward beyond the eye margin; antennae inserted slightly behind the anterior eye margin, intermediate segments elongate; postocular setae well developed although not extremely long.

*Mouth parts.* Mouth cones broadly rounded; slender maxillary stylets retracted far into the head, spaced fairly far apart.

*Thorax.* Epimeral sutures incomplete, not reaching posterior margins of pronotum; praepectus absent; mesopraesternum well developed; sculpture of metanotum intermediate between longitudinal striae and hexagonal reticulations; fore wings somewhat broad, not indented in the middle.

*Abdomen.* Pelta small, usually triangular, sometimes divided into three parts (Fig. 122); tube moderate in size, shorter than the tube of *Gynaikothrips*; males with glandular areas on several abdominal sternites.

Unlike most others in the Phlaeothripidae, males of *Holopothrips* possess glandular areas on more than one sternite of the abdomen. Often these areas occur in pairs on each sternite occupied. Such features are exhibited by many males in the Terebrantia although the shapes of their glandular regions are somewhat different.

This genus is similar to *Gynaikothrips*. *Holopothrips* is generally smaller and lacks strong pronotal striae. Both feed on living green leaves. In actual relationship *Holopothrips* is nearest the Javan genus *Aliothrips*. Besides distribution, *Aliothrips* differs in having the eyes spaced farther apart, the pelta simple (not divided into three parts as in *Holopothrips*), and the epimeral sutures complete.

Although most of the species inhabit South America, the following three species have been found in North America. The late Mr. Moulton believed that *Liothrips seini* Watson was in reality a species of *Holopothrips*.

<i>seini</i> (Watson), <i>Liothrips</i> (1927a:59).....	Santo Domingo
<i>signatus</i> Hood (1914c:50).....	Panama
<i>tenuis</i> Hood (1914c:52).....	Panama

### Hoplandrothrips Hood

*Phloeothrips* subgenus *Hoplandrothrips* Hood (1912d:145). Type species by original designation: *Phloeothrips* (*Hoplandrothrips*) *xanthopus* Hood.

(?) *Phloeobiothrips* Hood (1925d:127). Type species by original designation: *Phloeobiothrips tumiceps* Hood. New synonymy?



*Cryptothrips* subgenus *Cryptaplothrips* Priesner (1927:491; see Priesner 1928a). Type species by monotypy: *Cryptothrips famelicus* Priesner. New synonymy.

*Hoplandrothrips* subgenus *Pathothrips* Hood (1937b:498). Type species by original designation: *Hoplandrothrips (Pathothrips) proteus* Hood. New synonymy.

*Hoplandrothrips* subgenus *Gynoplothrips* Priesner (1949:104). Type species by original designation: *Hoplandrothrips arrhenus* Jacot-Guillarmod. New synonymy.

Thrips of the Phlaeothripinae with pointed mouth cones, with cheeks slightly widened, ordinarily bearing a prominent posterior pair of setae, usually with strong reticulations on at least the metanotum, and with a small bell-shaped pelta.

*Head.* Cheeks slightly expanded; eyes generally moderate to large in size, somewhat bean-shaped; antennae inserted forward of the anterior eye margin, segment III usually asymmetrical; basal pair of cheek setae often stouter than the rest; postocular setae well developed.

*Mouth cones.* Mouth cones commonly pointed; slender maxillary stylets retracted far into the head, usually touching in the center of the head.

*Thorax.* Metanotum usually strongly reticulate; praepectus absent; mesopraesternum degenerate; fore wings slightly constricted in the middle; fore femora, especially of males, often with subapical inner spurs.

*Abdomen.* Pelta small, usually bell-shaped (Fig. 123); tube moderate in size.

The genus *Hoplandrothrips* is best distinguished by an aggregate of characteristics rather than by a single feature. Many individual characteristics of this genus are found repeated in various degrees in other related genera but not in the same combination. Often, however, the shape of the head is distinctive. At best, the dividing lines between *Hoplandrothrips*, *Acanthothrips*, *Malacothrips* and even sections of *Phlaeothrips* are weak.

*Hoplandrothrips* contains a fairly large complex of species. Within the genus there are many forms, some large and elaborate, others medium in size and more modest in appearance, some in which the arch of the head is more noticeable (Fig. 64), some wingless degenerate types, and others with spectacularly developed parts of the body, especially on the metanotum. Between these various extremes are intermediates; and often, forms of the same species that usually exhibit unique structures will be without such peculiarities.

In past attempts to group the species, several subgenera of *Hoplandrothrips* have been proposed. One, the subgenus *Pathothrips* Hood, was set up for a species that, in the male sex, often bears metanotal projections. Another subgenus, *Gynoplothrips* Priesner, was erected to contain

the species in which only females had leg spurs. Too little is known of the species that might be included in *Gynoplothrips* to be certain that the females, especially the minor forms, always have armed femora and tibiae. In my opinion it does not seem worth while to retain subgenera that are based on characteristics peculiar to a certain form of one sex.

Occasionally it has been inferred that all males of *Hoplandrothrips* in the former strict sense have spurs on the fore femora and fore tibiae. Such an unqualified statement is erroneous. There are some species in which the major males may be so armed but the minor males may lack spurs on either or both the fore femur or fore tibia. Certainly the characteristic of armed fore legs cannot be considered distinctive of *Hoplandrothrips*. Not only are some males assigned to *Hoplandrothrips* unarmed, but also males in other genera of the subfamily Phlaeothripinae may have fully developed spurs on the fore legs. Males of *Phlaeothrips flavicauda* sometimes may exhibit spurs on the fore femora and fore tibiae. Apparently the armed condition is more common in large individuals and in large species of the Phlaeothripinae.

As defined herein, this genus includes all species formerly included in *Hoplandrothrips* and its subgenera; some species from *Phlaeothrips* in the sense of Hood (1912d), not Blanchard (1845), which includes, among others, *picticornis* but does not include *nodicornis* nor *coriaceus*, and two species from *Phloeobiothrips*. There seems to be little value in keeping *Phloeobiothrips* apart from other species of *Hoplandrothrips*. At most, this former genus is only a species complex containing but a few species whose claim to distinction is that their heads are more arched than normal and the fore tarsal teeth are absent in the female. *Cryptaplothrips* was erected for a European species which is very closely related to the American *H. microps*. I am unable at present to find key characteristics that would allow the separation of this species complex from the rest of the genus.

The similarities of species of *Hoplandrothrips* to those in the genus *Acanthothrips* are mentioned in the account of the latter genus. As far as is known, no larvae of *Hoplandrothrips* have head horns as do those of *Acanthothrips*.

Certain darkly colored *Adraneothrips* conceivably might be confused with *Hoplandrothrips*. The widely separated maxillary stylets, the posterior extension of the ventral part of the eyes, and the bicolored antennal segments of *Adraneothrips* distinguishes the latter genus from *Hoplandrothrips*. In addition, the pelta of *Adraneothrips* is usually smaller and more reduced than in *Hoplandrothrips*.

*Phlaeothrips major* may seem to approach *Hoplandrothrips*, especially *H. microps*. Except for abnormal individuals, all species of *Hoplandro-*

*thrips* have the metanotum strongly reticulate or striate; the metanotum in species of *Phlaeothrips* is either smooth or only faintly sculptured.

About two dozen species, most of them in series, were studied. Included were species from Canada, the United States of America, the United States of Mexico, and Honduras. In addition I have seen species from Australia, Micronesia, and Europe. The entire group is greatly in need of a thorough analytical revision.

<i>angustatus</i> Hood (1927f:199)	Arizona
<i>armiger</i> (Jones), <i>Phlaeothrips</i> (1912:23)	California
<i>brunneicornis</i> Bagnall (1917:23)	St. Vincent
<i>chapmani</i> (Hood), <i>Phlaeothrips</i> (1927a:227)	New York
<i>costano</i> Hood (1941:567)	California
<i>cubicola</i> Hood (1941:548)	Cuba
<i>forbesi</i> (Hood), <i>Phlaeothrips</i> (1940a:573)	New York
<i>funnebris</i> Hood (1912d:148)	Eastern U.S.A.
<i>gynandrus</i> Hood (1927a:232)	New York
<i>insolens</i> Hood (1912d:152)	Eastern U.S.A.
<i>jennei</i> (Jones), <i>Phlaeothrips</i> (1912:21)	Georgia
<i>juniperinus</i> Hood (1912d:146)	Eastern U.S.A.
<i>lissonotus</i> Hood (1941:561)	California
<i>mcateeii</i> Hood (1915a:38)	District of Columbia
<i>microps</i> Hood (1912d:150)	Eastern U.S.A.
<i>nigricestus</i> Hood (1933c:429)	Panama
<i>pallens</i> Hood (1941:559)	Cuba
<i>pergandei</i> (Hinds), <i>Phlaeothrips</i> (1902:197)	Eastern U.S.A.
<i>picticornis</i> (Crawford, J. C.), <i>Phlaeothrips</i> (1939:79)	New Jersey
<i>proximus</i> Hood (1927a:230)	Eastern U.S.A.
<i>quercuspumilae</i> Watson (1920b:19)	Florida
<i>raptor</i> (Crawford, D. L.), <i>Phlaeothrips</i> (1910:159)	Mexico
<i>russelli</i> Hood (1915a:36)	Arizona
<i>salicacearum</i> Hood (1941:564)	Western U.S.A.
<i>scutellaris</i> Hood (1941:550)	Eastern U.S.A.
<i>sycamorensis</i> Mason (1926:155)	California
<i>tumiceps</i> (Hood), <i>Phloeobiothrips</i> (1925d:127)	New York
<i>uzeli</i> Hinds (1902:196)	Massachusetts
<i>virago</i> Hood (1931b:164)	New York
<i>xanthopoides</i> Bagnall (1917:22)	St. Vincent
<i>xanthopus</i> Hood (1912d:145)	Eastern U.S.A.

#### Possible addition

<i>symmetricus</i> Hood (1941:557)	No locality recorded
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#### *Hyidiethrips* Hood

*Hyidiethrips* Hood (1938g:414). Type species by original designation: *Hyidiethrips atomarius* Hood.

Minute members of the *Phlaeothripinae* with antennae seven-segmented (rarely eight-segmented), with the third antennal segment greatly enlarged, and with the body setae inverted L-shaped.

*Head.* Small, strongly hexagonally reticulate; antenna normally seven-segmented, rarely eight-segmented and then only in brachypterous forms; antennal segment III greatly enlarged, oval; postocular setae long.

*Mouth parts.* Mouth cones broadly rounded; slender maxillary stylets retracted slightly into the head, spaced far apart.

*Thorax.* Prothoracic epimeral sutures incomplete, not reaching posterior margins, located more laterally than is usual in other genera of Tubulifera; center of pronotum with a transverse ridge; praepectus strongly developed; pterothorax with a median longitudinal ridge connecting the meso- and metafurcae; all tarsi probably one-segmented; fore wings extremely narrow, fringe cilia widely spaced, with no accessory cilia; major thoracic setae inverted L-shaped (Fig. 22).

*Abdomen.* Pelta seemingly in three parts, similar to Fig. 101; tube short; lateral abdominal setae mostly inverted L-shaped.

This genus is most similar to *Preeriella*. The differences between the two are not of great magnitude, but until intermediate species are found they can be considered as distinct genera. *Preeriella* lacks both the strong head reticulations and the peculiar long expansion of the tips of many of the body setae. In addition, *Hydiorhrips* has the morphological third and fourth antennal segments generally fused, whereas these segments are always separate in *Preeriella*.

Only one species has been described. It occurs in Florida. Before me is a specimen from southern Mexico which may or may not represent another species.

### *Idiorhrips* Faure

*Idiorhrips* Faure (1933:59). Type species by original designation: *Idiorhrips bellus* Faure.

This, the typical subgenus, does not occur in North America but only in Africa. It differs from the subgenera *Streptorhrips* and *Stegorhrips* mostly in the form of the last two antennal segments. In *Idiorhrips* the subterminal segment is much longer than the terminal segment. In *Streptorhrips* and *Stegorhrips* the subterminal segment is much shorter than the terminal segment. *Idiorhrips bellus*, the sole species, is known only in the apterous stage. *Idiorhrips* and subgenera are but a step forward phylogenetically from *Rhopalorhrips*.

### Subgenus *Streptorhrips* Hood

*Streptorhrips* Hood (1933c:431). Type species by original designation: *Streptorhrips conradi* Hood.

*Arcyothrips* Hood (1934b:114). Type species by original designation: *Arcyothrips africanus* Hood. New synonymy.



Small, roughly reticulated Tubulifera with an *Amphibolothrips*-like head, with antenna seven-segmented, and inhabiting at least the southern tip of Florida and the Keys, most of the Yucatan peninsula, and Panama.

*Head.* Elongate, rough (Fig. 46); eyes small, consisting of only a few facets; antennae inserted ventrally on the head, seven-segmented, although the combined morphological segments VII and VIII sometimes have a partial short suture line; postocular setae small to minute.

*Mouth parts.* Mouth cones pointed; slender maxillary stylets retracted far into the head, touching within the center of the head.

*Thorax* (apterous form). Major setae greatly dilated at tip; praepectus, propinasternum, and mesopraesternum absent; mesosternum separated along meson.

*Abdomen.* Pelta (at least in apterous form) broad as in Figs. 106 and 107; tube moderate in length.

*Forms.* Major forms with an oversized, greatly arched head and enlarged fore legs and prothorax. Females are known by apterous, brachypterous and macropterous specimens, males by the apterous form.

As mentioned in discussion of the typical subgenus, *Strepterothrips* and *Idiothrips* s. str. differ from each other primarily in the size of the subterminal and terminal antennal segments. Differences between *Strepterothrips* and *Stegothrips* are noted in the discussion of the latter subgenus.

Two species occur in North America. One species, *floridanus*, whose type locality is Islemorada (Upper Matecombe Key), Florida, is represented in the collections of the Illinois Natural History Survey by specimens collected from Tabasco, Campache, Key West, and the Everglades National Park near Homestead, Florida. The other species, *conradi*, is known from the type locality of Barro Colorado Island, Panama Canal Zone. Both species are found on dead branches.

These species may be distinguished by the following key:

- |   |                        |
|---|------------------------|
| Antennal segment III shorter than segment IV; fore part of head with a pair of prominent dilated setae..... | <i>conradi</i> Hood    |
| Antennal segment III longer than segment IV; fore part of head without prominent setae.....                 | <i>floridanus</i> Hood |

#### Subgenus *Stegothrips* Hood

*Stegothrips* Hood (1934b:111). Type species by original designation: *Stegothrips barronis* Hood.

The unique Panamanian *Stegothrips*, which I have never seen, is undoubtedly a close relative of *Strepterothrips*, yet the differences between the two are distinctive. Both *Idiothrips* s. str. and the subgenus *Strepterothrips* have complete epimeral sutures, lack any sizable suture between

the morphological seventh and eighth antennal segments, and the eyes are not bulged to the sides of the head. Thus *Stegothrips* may be easily recognized from its relatives by the characteristics of the incomplete epimeral suture, the extent of the partial suture on the terminal antennal segment which divides all of the ventral surfaces, and the bulged, laterally exposed eyes. In addition, the arch of the head is most pronounced in *Stegothrips* although this condition is not too greatly different from that found in major forms of *I. (Strepterothrips) floridanus*. The size of the subterminal and terminal antennal segments of *Stegothrips* is like *Strepterothrips* and not like *Idiothrips* s. str.

*Idiothrips*, composed of three subgenera as herein defined, is seemingly on the general line that leads to *Amphibolothrips*. If the position of the hind coxa of *Idiothrips* changed to move slightly sideways, a form similar to the African *Hoodiana* would result; if the hind coxal position was changed just slightly more sideways, *Idiothrips* would be unquestionably like *Amphibolothrips* except for a few details.

I do not believe, as Hood stated, that the several groups in *Idiothrips* are merely interesting examples of convergent evolution toward *Amphibolothrips*. Instead, it seems to me that *Idiothrips* is really a part of the phyletic line that gave rise to the former genus. Because *Idiothrips* has fewer structures reduced or elaborately developed, it should be placed on a side branch originating from an *Amphibolothrips* ancestor.

### Liothrips Uzel

*Liothrips* Uzel (1895:261). Type species by subsequent designation of Hood (1918): *Phloeothrips* [sic] *setinodis* Reuter.

*Phyllothrips* Hood (1908b:305). Type species by original designation: *Phyllothrips citricornis* Hood. Synonymized by Hood (1909b).

*Hoodia* Karny (1910:41). Type species by monotypy: *Hoodia austriaca* Karny. Synonymized by Priesner (1928a).

*Rhynchothrips* Hood (1912d:141). Type species by original designation: *Rhynchothrips pruni* Hood. New synonymy.

*Liophloeothrips* Priesner (1919b:138). Type species by original designation: *Liophloeothrips glaber* Priesner. New synonymy.

*Rhycothrips* [sic] Hood, Moulton and Steinweden (1930). Misspelling for *Rhynchothrips*.

Black thrips of medium size, often with large eyes, with metanotum closely longitudinally striate or strongly or weakly hexagonally reticulate, usually with long pointed mouth cones, without praepectal plates, and usually with a small triangular pelta. See also *Gnophothrips*.

*Head.* Elongate to short (Fig. 66); eyes often large, sometimes twice as long as the length of antennal segment I; ocelli usually borne on raised area; postocular setae well developed; intermediate antennal segments moderately to slightly elongate.



*Mouth parts.* Mouth cones long, pointed but sometimes somewhat rounded; slender maxillary stylets retracted far into the head, usually meeting in the center of the head.

*Thorax.* Praepectus absent; mesopraesternum degenerate; fore wings somewhat broadened, not indented in the middle; metanotum usually closely longitudinally striate, occasionally hexagonally reticulate although weakly so in midportion.

*Abdomen.* Pelta usually small, triangular (Fig. 114); tube moderate in size, slender.

This genus is a difficult one. It grades almost imperceptibly into *Phlaeothrips* and into *Gynaikothrips*.

In the main, species that previously were classed as *Liothrips* are slender and well developed. Those that were classed as *Rhynchothrips* are shorter, slightly degenerate species. Even in this older classification there were intermediate species that bridged gaps between those genera. *Liothrips tridentatus* was usually assigned to *Rhynchothrips*, but it could have been assigned to *Liothrips* just as reasonably. To illustrate this point, Hood placed his species *leucogonis* in *Liothrips* and *tridentatus* in *Rhynchothrips*. So far I have not been able to find specific differences between *leucogonis* and *tridentatus*, let alone generic differences; the two may be names for the same species. The camphor thrips, *Liothrips floridensis*, seemingly combines features of *Liothrips* and *Rhynchothrips* in the old sense.

Perhaps *Gnophothrips* might take its place as a complex of *Liothrips*. For the present I consider *Gnophothrips* a separate genus only because *Gnophothrips* lacks accessory fringe cilia on the fore wings. In *Liothrips* accessory fringe cilia are always present in the winged forms.

A connecting link between *Liothrips* and *Phlaeothrips* might be the species *Phlaeothrips longitubus*. This species has a long mouth cone although its tip is somewhat bluntly rounded, the head is transversely striate as in most species of *Liothrips*, and the tube is moderately long and slender—even longer than in some species previously assigned to *Rhynchothrips*.

Many of the dozens of North American species are presumed to feed on living leaf tissues. *Liothrips russelli* most definitely feeds on the juices from leaves of Virginia creeper. Others such as *Liothrips pruni* may feed on juices from the cambium layer of cherry trees. On the other hand I have often observed *Liothrips citricornis* on the underside of hickory and grape leaves apparently feeding on galls caused by other insects. Perhaps *citricornis* is the same species that Fitch believed to feed on *Adelges* galls. Some few are of economic importance, feeding on bulbs or on foliage of tropical fruit trees.

ampelopsidis (Moulton), Rhynchothrips (1927:197) . . . .	Colorado
antennatus Priesner (1933c:153) . . . . .	Mexico
araliae Hood (1935a:92) . . . . .	Panama
avocadis Hood (1935a:97) . . . . .	Panama
barronis Hood (1936c:261) . . . . .	Panama
bibbyi Watson (1923:79) . . . . .	Mexico
bispinosus Hood (1938g:412) . . . . .	Panama
brevicornis Hood (1913a:164) . . . . .	Virginia
brevitubus (Moulton), Rhynchothrips (1929b:19) . . . . .	Mexico
buffae (Hood), Trichothrips (1908a:369) . . . . .	Illinois
caryae (Fitch), Phloeothrips [sic] (1856:445) . . . . .	Eastern U.S.A.
castaneae Hood (1915e:76) . . . . .	Eastern U.S.A.
citricornis (Hood), Phyllothrips (1908b:305) . . . . .	Eastern U.S.A.
colimae Moulton (1929b:17) . . . . .	Mexico
cordiae Hood (1935a:99) . . . . .	Panama
corni Moulton (1926:124) . . . . .	California
debilis (Hood) Rhynchothrips (1925e:218) . . . . .	New Jersey
dendropogonis Watson (1938:14) . . . . .	Florida
dentifer (Hood), Rhynchothrips (1912d:143) . . . . .	Michigan
dumosa Moulton (1907:63) . . . . .	California
flavoantennis Watson (1916:129) . . . . .	Florida
floridensis (Watson), Cryptothrips (1913:145) . . . . .	Florida
fuscus (Morgan), Trichothrips (1913:30) . . . . .	Florida
gaviotae (Moulton), Haplothrips (1929a:132) . . . . .	California
ilex (Moulton), Trichothrips (1907:62) . . . . .	California
laureli (Mason), Cryptothrips (1922:193) . . . . .	Florida
leucogonis Hood (1915e:78) . . . . .	Eastern U.S.A.
mexicanus Crawford, D. L. (1910:161) . . . . .	Mexico
montanus Hood (1913a:163) . . . . .	Montana, Ontario
muscorum Watson (1926b:60) . . . . .	Florida
ocellatus (Hood), Phyllothrips (1908a:375) . . . . .	Eastern U.S.A.
penetralis Hood (1935a:95) . . . . .	Panama
perseae Watson (1923:80) . . . . .	Honduras
piger (Hood), Rhynchothrips (1925c:134) . . . . .	Colorado
pruni (Hood), Rhynchothrips (1912d:142) . . . . .	Eastern U.S.A.
querci Moulton (1929b:18) . . . . .	Mexico
rostratus (Hood), Rhynchothrips (1927f:203) . . . . .	Arizona
russelli (Hood), Rhynchothrips (1925a:31) . . . . .	Eastern U.S.A.
sambuci Hood (1913a:163) . . . . .	Eastern U.S.A.
tridentatus (Shull), Trichothrips (1909:226) . . . . .	Eastern U.S.A.
umbripennis (Hood), Phyllothrips (1909a:30) . . . . .	Eastern U.S.A.
usitatus (Hood), Rhynchothrips (1927d:113) . . . . .	Southeastern U.S.A.
vaneeckei Priesner (1920:211) . . . . .	Cosmopolitan
varicornis Hood (1912b:74) . . . . .	California, Mexico
versicolor (Moulton), Rhynchothrips (1929c:239) . . . . .	Virginia
xanthocerus Hood (1927f:203) . . . . .	Southwestern U.S.A.
zeteki Hood (1913c:120) . . . . .	Panama, Honduras

### **Lispothrips O. M. Reuter**

*Lispothrips* O. M. Reuter (1899:17). Type species by monotypy: *Lispothrips wasastjernai* Reuter.

Dark thrips resembling species of *Haplothrips*, except with cheeks rough and bearing several stout setae and lacking praepectal plates on the prosternum.

*Head.* Cheeks usually roughly serrate with several pairs of stout setae; eyes somewhat reduced, slightly bulged; antennal segment III without sense cones, generally small but at least as long as segment IV.

*Mouth parts.* Mouth cones broadly rounded to pointed; slender maxillary stylets retracted far into the head, spaced far apart, or nearly touching within the center of the head.

*Thorax.* Epimeral sutures sometimes incomplete; praepectus absent; prospinasternum sometimes greatly reduced; mesopraesternum lacking; wings rarely present.

*Abdomen.* Pelta large in wingless forms (Figs. 115-17), smaller in winged forms; tube moderate in size.

Apparently the type species *wasastjernai* is not now known to anyone. Instead *Lispthrips* of most authors is based, in practice, on the species *crassipes* and the interpretations given by Karny (1921) and Priesner (1928a). Usually the species are represented in collections by brachypterous forms, but before me is a series of macropterous specimens from Alaska.

This genus is a Holarctic group and no North American species is found south of Texas.

*birdii* Moulton (1930:286).....Manitoba  
*brevicruralis* (Shull), *Trichothrips* (1909:227). New  
 combination .....Michigan  
*crassipes* (Jablonowski), *Phloeothrips* [*sic*] (1894:44) ..Holarctic  
*populi* Moulton (1930:287).....British Columbia  
*salicarius* (Hood), *Rhynchothrips* (1913a:164).....Maryland, New York  
*varicornis* Moulton (1929c:240).....Texas, Arkansas

### **Lissothrips Hood**

*Lissothrips* Hood (1908a:365). Type species by monotypy: *Lissothrips muscorum* Hood.

*Lissothrips* subgenus *Prolissothrips* Morgan (1925:5). Type species by monotypy: *Lissothrips* (*Prolissothrips*) *stratulus* Morgan. New synonymy.

Tiny dark greenish thrips with small eyes, antennal segment III short, and the pelta closely adjoined to the anterior margin of abdominal tergum II, not divided into three parts.

*Head.* Short; eyes small, with ten to a dozen facets exposed dorsally; antennal segment III short, shorter than both segments II and IV, with one sense cone or none.

*Mouth parts.* Mouth cones pointed; slender maxillary stylets retracted

slightly, to far, into the head, usually positioned far apart within the head.

*Thorax.* Epimeral sutures often incomplete; praepectus present; mesopraepectus degenerate; mostly brachypterous, rarely with fully developed wings.

*Abdomen.* Pelta moderate in size, not subdivided (Fig. 109); tube short.

In spite of the obvious specialization by degeneracy of certain parts, that is, in the sculpture, the eyes, and in the thorax, this genus probably is a remnant of the primitive Phlaeothripinae stock. *Lissothrips* has well-developed praepectal plates which are generally lost in the higher forms of the Phlaeothripinae; it still has a fairly broad pelta; and all segments of the antenna are separate. While most specimens lack wings, the late Mr. J. C. Crawford told me that he had seen a winged form and Hood reported winged forms in 1954 (p. 23).

A close relative of *Lissothrips* is *Trisclerothrips*. In *Trisclerothrips* the last two antennal segments are fused, whereas in *Lissothrips* these are well separated. In other groups such as *Phlacothrips*, *Haplothrips*, and in the genus *Williamsiella*, each third antennal segment is small; but in *Lissothrips* segment III is proportionately even smaller. These aforementioned genera further differ either in having two sense cones on antennal segment III, or in having short posterior setae on abdominal segment IX which are shorter than the tube, or in having the pelta small and triangular instead of large and broad.

As far as is known, species of *Lissothrips* are moss feeders. They are found from at least as far north as Michigan and Ontario, south to Brazil. In North America, including the Greater Antilles, there are about seven species, of which two or three are undescribed. The four described species are:

<i>claripes</i> Hood (1940a:571).....	Florida
<i>muscorum</i> Hood (1908a:365).....	Eastern U.S.A.
<i>ocellatus</i> Hood (1939:594).....	Texas
<i>stratulus</i> Morgan (1925:5).....	Puerto Rico

### **Malacothrips Hinds**

*Malacothrips* Hinds (1902:200). Type species by monotypy: *Malacothrips zonatus* Hinds.

Bulge-eyed thrips with cheeks incut just behind eyes, without praepectal plates, with a relatively small pelta and inhabiting grassland principally in eastern United States.

*Head.* Weakly but definitely reticulate (Figs. 70, 71); eyes bulged, not elongated ventrally; cheeks incut just behind eyes; antennae inserted



anterior to the eyes; antenna eight-segmented; postocular setae extremely long.

*Mouth parts.* Mouth cones bluntly pointed to broadly rounded; slender maxillary stylets retracted about halfway into the head, usually sigmoidal.

*Thorax.* Epimeral sutures complete; major pronotal setae well developed (Fig. 70); praepectus absent; mesopraesternum well developed to somewhat degenerate; fore wings slightly narrowed in the middle, accessory fringe cilia present.

*Abdomen.* Pelta small (Figs. 130, 131); males occasionally with small glandular areas on sternite VIII.

Because of the bulged eyes and notched cheeks, the genus *Malacothrips* resembles *Eurythrips*. These two can be distinguished, but not easily. *Malacothrips* lacks praepectal plates, whereas these plates are usually present in *Eurythrips*. Probably *Adraneothrips* is the nearest relative of *Malacothrips*. The only major difference between the two is in the shape of the eyes. Most species of the genus *Adraneothrips* have the eyes elongated ventrally and the cheeks are not incut behind the eyes. One species, *Malacothrips adranes*, resembles several species of *Adraneothrips* in coloration. On the other hand *Malacothrips* resembles some species of *Hoplandrothrips* in general body form and head reticulations; in some instances differentiation is difficult. Clearly *Malacothrips* is a derivative of the *Phlaeothrips* stem.

Possibly three species may be assigned to *Malacothrips* in North America. A key to them follows.

1. Antennal segment VIII with a broad pedicel; tube bright yellow at base; maxillary stylets far apart. New York to Virginia, as presently known . . . . . *roycei* Hood  
Antennal segment VIII with a slender pedicel; tube dark at base; maxillary stylets close together although not touching. . . . . 2
2. Middle pair of posterior dorsal setae on abdominal segment IX longer than tube, pointed at tip; abdominal segment IX brown. Northeastern United States . . . . . *zonatus* Hinds  
Middle pair of posterior dorsal setae on abdominal segment IX shorter than tube, slightly dilated at tip; abdominal segment IX mostly yellow. Southern Florida . . . . . *adranes* Hood

The name *Eurythrips flavacinctus* Moulton and Andre is synonymous with *zonatus* Hinds according to the late Mr. Moulton (unpublished notes 1948) and according to Hood (1952b:150).

#### Macrophthalmothrips Karny

*Ophthalmothrips* Karny (1920:38). Type species by original designation:



*Ophthalmothrips argus* Karny. Preoccupied by *Ophthalmothrips* Hood (1919a).

*Macrophthalthmothrips* Karny (1922:34). New name for *Ophthalmothrips* Karny.

Holoptic-eyed thrips with long pointed mouth cones, slender wings, and a short tube.

*Head.* Eyes large, touching or nearly touching on the dorsum at the anterior and posterior mesal angles (Fig. 72); ocellar area raised, encircled by the eyes; antennae inserted ventrally on the head, posterior to the forward, dorsal eye margin; antennal segments VII and VIII often partially fused; postocular setae small.

*Mouth parts.* Mouth cones extremely long and pointed; slender maxillary stylets retracted far into the head, touching within the center of the head.

*Thorax.* Epimeral sutures incomplete, much as in *Amphibolothrips*; pronotum with a transverse median ridge; metanotum somewhat longitudinally striate; praepectus absent; mesopraesternum degenerate; fore wings narrow, sparsely fringed with cilia.

*Abdomen.* Pelta small, triangular (Fig. 121); sides of abdomen with many decumbent spinules; tube short.

Most likely, *Macrophthalthmothrips* had its origin near the common ancestor that gave rise to *Acanthothrips*, *Neurothrips*, and *Eupathithrips*. Like all three of the latter named groups, *Macrophthalthmothrips* has long pointed mouth cones, no praepectus, large eyes, fore femoral spurs occasionally (Karny 1923), small pelta, and long slender maxillary stylets. In some species the coloration approaches that found in typical species of *Neurothrips*.

By certain characteristics, *Macrophthalthmothrips* shows interesting relationships to *Preeriella* and *Hyidiethrips*. In *Macrophthalthmothrips* the fore wings are narrowed with the fringe cilia spaced far apart and the pronotum has a slightly defined transverse ridge. Both of these characteristics are more pronounced in *Preeriella* and *Hyidiethrips*. *Adraneothrips* has wings similar to the preceding, but those of *Macrophthalthmothrips* are similar especially to *Preeriella*. Even though *Preeriella* could hardly be considered to be a relative of *Macrophthalthmothrips*, the fact that both of these genera have similarly formed wings indicates that they may have been subjected to the same evolutionary forces.

First known from Australia, this genus has subsequently been found in North and South America, Hawaii, Malaya, and Africa. They are little thrips, quick on the take-off, living on dead branches in the warmer parts of the world. Hood (1934a) reports *narcissus* as being sluggish in gait, but the species that I have encountered in Mexico were most lively. Because of the light colored stripes on each side of the body they

look like sinuating threads, especially on the background of a white beating net.

Two species occur in North America; the species *M. helenae* has been found as far north as North Carolina. Most of the New World species, possibly all of them, have antennal segments VII and VIII partially fused.

### Metriothrips Hood

*Metriothrips* Hood (1936c:275). Type species by original designation: *Metriothrips midas* Hood.

Broad-abdomened, weakly sclerotized, long-legged Tubulifera with relatively small eyes, with four prominent ocellar setae, with intermediate antennal segments having long pedicels; inhabitants of Mexico, Panama, and Trinidad.

*Head.* Suggestive of *Eurythrips* except that eyes are not strongly keglike nor cheeks incut behind eyes; antennal sockets protruding forward; intermediate antennal segments elongate; ocellar setae prominent.

*Mouth parts.* Mouth cones pointed; slender maxillary stylets retracted far into the head, spaced fairly far apart; wide maxillary bridge conspicuous in Hoyer's mounting media.

*Thorax.* Epimeral sutures usually incomplete but sometimes complete; praepectus possibly present; mesopraesternum seemingly degenerate; only apterous forms known. Anterolateral prothoracic setae minute, all other major setae well developed.

*Abdomen.* Broad; pelta small, weakly defined (Fig. 124); sternites without transverse median row of setae, only posterior setae present; tube moderate in size; anal setae shorter than tube length.

Probably *Metriothrips* is the degenerate remnant of a group derived from the Glyptothripini. Such placement, first suggested by Hood (1936c), is based on the similarities of the shape of antennae, the tendency for the prothoracic epimeral suture to fade out posteriorly, and the over-all appearance of *Metriothrips* to certain complexes of *Eurythrips*. Unlike all other Tubulifera, *Metriothrips* lacks a transverse, median row of setae on each of the sternites of the abdomen.

Until this writing only two specimens were known, the type specimens of *midas* of Panama and *secundus* of Trinidad. A possible third species, as yet undescribed, represented by seven specimens, is before me. They were discovered recently in Mexico.

### Neothrips Hood

*Neothrips* Hood (1908a:371). Type species by monotypy: *Neothrips corticis* Hood.

Small degenerate species near *Phlaeothrips*, with long pointed mouth cones, tiny eyes composed of but few facets located at the side of the head, and the last two antennal segments closely joined to form a compact pseudosegment.

*Head.* Elongate, smooth; eyes small, located at the sides of the head rather than along the anterior margin; antennal segments VII and VIII closely joined into a compact mass but with a fine suture dividing them.

*Mouth parts.* Mouth cones long and pointed; slender maxillary stylets retracted far into the head, nearly touching in the center of the head.

*Thorax.* Praepectus absent; mesopraesternum rudimentary; wings reduced to pads in the species known.

*Abdomen.* Pelta moderately small, triangular; tube short, thick, and with faint evidence of ridging.

Seemingly this genus is composed of degenerate variants of species types found in the genus *Phlaeothrips*. Certain of the characteristics of *Neothrips*, such as the elongate, smooth head, and the long pointed mouth cones are suggestive of similar features in *Phl. angusticeps*. Wat-son (1927b) also noted, although indirectly, such close association between *Neothrips* and *angusticeps* in his account of *Polyporothrips*, a new name for the *angusticeps* complex.

In North America there are but two species, *corticis* the type species and an undescribed one from ash. Both live under the bark of trees.

### Neurothrips Hood

*Neurothrips* Hood (1924a:315). Type species by original designation: *Acanthothrips magnafemoralis* Hinds.

Large-eyed, extravagantly adorned and colored thrips with body covered by netlike reticulations, many seta-bearing warts on the expanded cheeks, extremely long anal setae, with bent wings, and often with broad, leaflike, wing-holding setae. This genus is confined to the New World, occurring from northeastern United States to Peru and Brazil.

*Head.* Eyes large, bean-shaped (Fig. 76); cheeks greatly expanded with seta-bearing warts; intermediate antennal segments vasiform; post-ocular setae small, dilated at tips, located on the median third of the head.

*Mouth parts.* Mouth cones long and pointed; slender maxillary stylets retracted far into the head, touching within the center of the head.

*Thorax.* Praepectus absent; mesopraesternum nearly fully developed; fore wings bent; with or without accessory fringe cilia.

*Abdomen.* Pelta small, rectangular (Fig. 135); wing-retaining setae

often increased to three pairs, broad and leaflike (Fig. 20); tube fairly long; anal setae more than four times as long as tube.

*Neurothrips* is one of the most specialized genera to have evolved from the *Phlaeothrips-Acanthothrips* stem. The distinctive form of *Neurothrips* is the result of an increase in size of setae or in the expansion of setae and head cheeks. It does not differ from *Acanthothrips* by any structural additions or subtractions, but only in the elaboration of certain structures.

More than any other *Acanthothrips*, *A. amoenus* of Brazil is the closest approach to *Neurothrips*, according to Hood (1949). In color, variegated brown, yellow, and white, *amoenus* apparently resembles more the species of *Neurothrips* than species of *Acanthothrips*. In structure, on the other hand, *amoenus* does not have the essential features of a *Neurothrips*. Like all *Acanthothrips*, *amoenus* does not have extremely widened cheeks, the wing-retaining setae are not enlarged or leaflike, and the anal setae are not four times as long as the tube but only about twice as long.

Three species occur in North America. One, *Neurothrips magnafemoralis*, occurs from Massachusetts west to Iowa and south to Florida. Another species, *N. punanus* new species, inhabits southern Mexico. A key to some of the known species follows.

1. Abdominal segment VIII dorsally with two pairs of differentiated wing-retaining setae; fore femur without subapical spurs. Panama and Peru ..... *williamsi* Hood  
     Abdominal segment VIII dorsally without differentiated wing-retaining setae; fore femur with subapical spurs.....2
2. Fore wing with several (6 or 7) accessory fringe cilia; tube entirely dark brown, becoming black in basal half. Peru..... *allopterus* Hood  
     Fore wing without accessory fringe cilia; tube bicolored, pale yellow in basal portion, black in apical portion.....3
3. Fore femur brown. Northeastern U.S.A..... *magnafemoralis* Hinds  
     Fore femur mostly whitish yellow. Southern Mexico... *punanus* n. sp.

#### *Neurothrips punanus* new species

*Female* (macropterous). Length distended, exclusive of the antennae and setae, about 2.5 mm. Color variously black, brown shading to tan, yellow, white and red. Brown: most of the head; antennal segments I and II, upper middle of segments III and IV, middle of segment V, and all of segments VII and VIII; all coxae, outer spots on femora, tibiae, and tarsi, central longitudinal line in each wing; lateral parts of the pelta, and middle and lateral spots on abdominal segments II to VII. Yellow:



all parts of antennae not brown, deepest yellow in antennal segment VI; most of the abdomen except extreme sides, especially yellow in abdominal segment VIII. White: cheek warts; most of legs; a border completely around the prothorax; two pairs of lateral spots on the pterothorax; the center and sides of abdominal segment II, most of the lateral margins of abdominal segments III to VII. Red: subintegumental pigments of the ocelli, thorax and abdomen. Black: apical three-fifths of the tube.

Head and prothorax similar to Fig. 76. Fore femur and fore tarsus each with a strong spur. Pelta as in Fig. 135. Abdominal segment VIII without specialized wing-retaining setae, the dorsal setae of this segment—except posterior ones—small, stretching over only two or three rows of hexagonal reticulations.

*Male* (macropterous). Length distended, exclusive of the antennae, about 2 mm. Smaller but similar to female. Glandular area of abdominal sternum VIII as a short thin transverse line that is slightly widened at either end.

*Holotype*: Female; Ocosingo Valley, near the Lacandon Indian village of Puna at the Finca Monte Libano, Chiapas, Mexico; July 5, 1950 (L. J. Stannard and C. & M. Goodnight); beating dead citrus limbs at edge of jungle. *Allotype*: Male; Ocosingo Valley, Finca St. Antonio, Chiapas, Mexico; June 28, 1950 (L. J. Stannard and C. & M. Goodnight); beating dead oak twigs and leaves. *Paratypes*: 1 ♀, same data as for holotype. 3 ♀s, 5 ♂s, same data as for allotype. 1 ♀, Campeche, Campeche; July 7, 1951 (L. J. Stannard); from dead limbs. 1 ♀, 1 ♂, Chichen Itza, Yucatan; June 29, 1951 (L. J. Stannard); from dead limbs.

This species is most closely related to its nearest neighboring congener, *magnafemoralis*. Both *punanus* and *magnafemoralis* differ from the South American *Neurothrips* in many characters, principally those mentioned in the accompanying key.

### Orthothrips Priesner

*Orthothrips* Priesner (1925b:23). Type species by original designation: *Orthothrips caudatus* Priesner.

Reticulate-headed members of the Phlaeothripinae with each antenna eight-segmented, prothoracic anteromarginal setae minute, and long, nonhexagonally reticulate tubes.

*Head*. Longer than wide, entirely covered by hexagonal reticulations, cheeks incut behind eyes; postocular setae very short; each antenna eight-segmented; segments III and IV with several setae which are blunt or dilated at the tips.



*Mouth parts.* Mouth cones short, broadly rounded; maxillary stylets slender, placed fairly far apart within head.

*Thorax.* Prothorax short; most major prothoracic setae not greatly developed, anteromarginal setae minute; epimeral sutures always complete; praepectus present or absent; probasisternum sometimes fused into one plate; mesopraesternum well developed to greatly reduced; fore wings, when present, without accessory fringe cilia.

*Abdomen.* Pelta elongate oval, to trapezoidal, to "derby"-shaped; occasionally wing-holding setae somewhat expanded; tube long (longer than head in female, just slightly shorter than head in male), never hexagonally reticulate but sometimes with ridges at base of tube.

*Orthothrips* is a name for a block of species which are fundamentally like *Eschatothrips* except that the members of *Orthothrips* have longer, nonreticulated tubes. Between species and even within a single species, considerable variability of some characteristics apparently exists. As a result the genus is not a homogeneous one, especially in South America.

Three species occur in North America.

<i>bilineatus</i> Stannard (1955a:96).....	Jamaica
<i>boneti</i> Stannard (1955a:97).....	Mexico
<i>dubius</i> Stannard (1955a:98).....	Mexico

### ***Phlaeothrips* Haliday**

*Phlaeothrips* Haliday (1836:441). Type species by subsequent designation of Blanchard (1845): *Thrips ulmi* Fabricius. Valid.

Type species by subsequent designation of Hood (1912d): *Phlaeothrips coriacea* Haliday. Invalid; prior designation by Blanchard.

Type species by subsequent designation of Morison (1949): *Phlaeothrips pedicularia* Haliday. Invalid; prior designation by Blanchard.

*Phloeothrips* Amyot and Serville (1843:640). Emendation of *Phlaeothrips*.

*Hoplothrips* Amyot and Serville (1843:640). Type species by subsequent designation of Karny (1912): *T[h]rips corticis* De Geer. New synonymy.

*Trichothrips* Uzel (1895:246). Type species by subsequent designation of Hood (1915d): *Phlaeothrips pedicularia* Haliday. New synonymy.

(?) *Agnostochthona* Kirkaldy (1907:102). Type species by monotypy: *Agnostochthona alienigera* Kirkaldy. New synonymy?

*Dolerothrips* Bagnall (1910b:682). Type species by original designation: *Dolerothrips flavipes* Bagnall. New synonymy.

*Pygmaeothrips* Karny (1920:40). Type species by monotypy: *Pygmaeothrips columniceps* Karny. New synonymy.

*Phloethrips* Watson (1923:48). Typographical error for *Phlaeothrips*.

*Neoeurhynchothrips* Watson (1923:77). Type species by original designation: *Neoeurhynchothrips cubensis* Watson. New synonymy.

*Polyporothrips* Watson (1927b:61). Type species by original designation: *Polyporothrips longipilosus* Watson. New synonymy.

(?) *Carathrips* Hood (1950a:41). Type species by original designation: *Trichothrips mediamericus* Hood. New synonymy?

Medium-sized to small thrips usually with weak body reticulations, with small eyes, always with antenna eight-segmented, and usually without the dominant characteristics of the other genera in the Phlaeothripinae.

*Head.* Small to somewhat elongate, weakly reticulate to smooth (Figs. 67, 68); eyes small, often not much longer than the length of antennal segment I; postocular seta well developed; usually basal cheek setae, if conspicuous, larger than the anterior ones; antenna eight-segmented, intermediate segments rarely long although segment III is usually the longest.

*Mouth parts.* Mouth cones broadly rounded to pointed (Fig. 7); slender maxillary stylets retracted far into the head, often touching in the center of the head.

*Thorax.* Epimeral suture usually complete; praepectus commonly absent; mesopraesternum degenerate; metanotum without strong reticulations; fore wings moderately broad; fore femora rarely with inner spurs.

*Abdomen.* Pelta broad to small (Figs. 111-13); tube moderately long to short; males frequently bear glandular areas on sternite VIII.

In the sense used here, *Phlaeothrips* includes most of those species previously assigned to *Hoplothrips* and *Trichothrips*. Morison in 1949 also considered *Phlaeothrips* in the same manner but for other reasons. Species that generally were placed in *Phlaeothrips* during the first half of the twentieth century—that is, the large-eyed, warty-cheeked thrips—are herein assigned to the genus *Acanthothrips*.

Such a change in the concept of *Phlaeothrips* is necessary if the rule of priority is to be followed. Blanchard in 1845 chose *Thrips ulmi* Fabricius as the type species. Unfortunately, Blanchard's designation has been overlooked and other designations were proposed. *Phlaeothrips ulmi* is *Hoplothrips*-like in the old sense; it is not large-eyed and warty-cheeked.

*Phlaeothrips* is a heterogeneous group composed of a number of diverse types. Included are species which are generalized and lack distinctive features. Included also are species whose structures are intermediate between the simple condition found in the generalized species and the more complex condition typical of those in higher genera, and there are even some species in this genus with rudiments of highly specialized characteristics. Taxonomically *Phlaeothrips* could be considered the "wastebasket" genus; phylogenetically it could be considered the base stem genus of the advanced Phlaeothripinae.

In general these thrips feed on fungi which grow in debris or on dead twigs and branches. There are about forty-eight species in North America.

- aciculatus* (Hood), *Hoplothrips* (1941:151) . . . . . Florida  
*americanus* (Hood), *Trichothrips* (1908a:366) . . . . . Eastern U.S.A.  
*ampleiceps* (Hood), *Trichothrips* (1938c:376) . . . . . Southern U.S.A.  
*angusticeps* (Hood), *Trichothrips* (1908a:367) . . . . . Eastern U.S.A.  
*anomocerus* (Hood), *Trichothrips* (1912c:137) . . . . . Eastern U.S.A.  
*argus* (Hood), *Hoplothrips* (1939:587) . . . . . Texas  
*asymmetricus* (Watson), *Trichothrips* (1937a:8) . . . . . Alabama  
*beachi* (Hinds), *Trichothrips* (1902:192) . . . . . Eastern U.S.A.  
*bradleyi* (Hood), *Hoplothrips* (1950c:139) . . . . . Cuba, Panama  
*brevitubus* (Watson), *Trichothrips* (1918:97) . . . . . Florida  
*bruneri* (Watson), *Plectrothrips* (1933b:18) . . . . . Cuba  
*corticis* (De Geer), *Thrips* (1773: ? ) . . . . . ?Holarctic  
*copiosa* (Uzel), *Trichothrips* (1895:252)  
*cubensis* (Watson), *Neoeurhynchothrips* (1923:78) . . . Cuba  
*delicatulus* (Hood), *Hoplothrips* (1939:590) . . . . . Texas to Brazil  
*ferecaecis* (Priesner), *Pygmaeothrips* (1929:191) . . . . . Mexico  
*fieldsi* (Crawford, J. C.), *Trichothrips* (1939:77) . . . . . Eastern U.S.A.  
*flavicauda* (Morgan), *Trichothrips* (1913:28) . . . . . Eastern U.S.A.  
*myceticola* (Crawford, J. C.), *Trichothrips*  
(1939:75)  
*flumenellus* (Hood), *Trichothrips* (1931b:159) . . . . . New York  
*fumiceps* (Hood), *Trichothrips* (1925a:29) . . . . . New York  
*fuscicornis* (Hood), *Trichothrips* (1916b:122) . . . . . Maryland  
*graminis* (Hood), *Trichothrips* (1933c:409) . . . . . Panama  
*hoodi* (Morgan), *Trichothrips* (1913:31) . . . . . Tennessee  
*karnyi* (Hood), *Trichothrips* (1914a:20) . . . . . Eastern U.S.A.  
*kincaidi* (Moulton), *Hoplothrips* (1929c:241) . . . . . Washington  
*leibyi* (Hood), *Trichothrips* (1938c:372) . . . . . North Carolina  
*longipilosus* (Watson), *Polyporotherips* (1927b:62) . . . Florida  
*longitubus* (Hood), *Trichothrips* (1908a:368) . . . . . Illinois  
*major* (Hood), *Trichothrips* (1914d:153) . . . . . Eastern U.S.A.  
*marginialis* (Hood and Williams), *Trichothrips*  
(1915:128) . . . . . Southeastern U.S.A.  
*mediamericanus* (Hood), *Trichothrips* (1933c:412) . . . Panama  
*militaris* (Hood), *Trichothrips* (1933c:411) . . . . . Panama  
*minitalis* (Hood), *Hoplothrips* (1954b:279) . . . . . Florida, North Carolina  
*moultoni* (Hood), *Trichothrips* (1934a:66) . . . . . Panama  
*niger* (Franklin), *Trichothrips* (1908:725) . . . . . Barbados  
*occipitalis* (Hood), *Trichothrips* (1933c:411) . . . . . Panama  
*orbiceps* (Hood), *Trichothrips* (1933c:410) . . . . . Panama  
*pergandei* (Hood), *Trichothrips* (1927d:115) . . . . . Eastern U.S.A.  
*rubicundulus* (Hood), *Trichothrips* (1938c:370) . . . . . Florida  
*rufescens* (Hood), *Hoplothrips* (1941:617) . . . . . Panama  
*sculpticollis* (Hood), *Trichothrips* (1938c:374) . . . . . Florida  
*smithi* (Hood), *Trichothrips* (1909a:29) . . . . . Illinois  
*tejas* (Hood), *Hoplothrips* (1939:583) . . . . . Texas  
*terminalis* (Hood and Williams), *Trichothrips*  
(1915:130) . . . . . Florida  
*tyrannus* (Hood), *Trichothrips* (1933c:413) . . . . . Panama  
*westfalli* (Hood), *Hoplothrips* (1954b:279) . . . . . Florida

wilsoni (Watson), Hoplothrips (1937c:17) . . . . . Florida  
 xanthocephalus (Hood), Trichothrips (1936b:97) . . . . Louisiana  
 zonatus (Hood), Trichothrips (1914d:154) . . . . . Panama

### Phrasterothrips Priesner

*Phrasterothrips* Priesner (1921:210). Type species by monotypy: *Phrasterothrips conducans* Priesner.

*Diploacanthothrips* Moulton (1933a:239). Type species by original designation: *Diploacanthothrips fuscus* Moulton. Synonymized by Priesner (1949).

Medium-sized thrips which usually have two pairs of long epimeral setae, whose males have the major posterior setae on abdominal tergite IX equally long, and with each antenna eight-segmented.

Although principally a genus of South American distribution, some specimens have been found recently in Costa Rica and Florida. Apparently these specimens represent new species.

This genus may be represented by species which are of two distinctive kinds. One is the normal type in which the individuals bear two pairs of long epimeral setae. In the other type, individuals have a longer head and each of the inner pair of epimeral setae are small. In Brazil, for example, *conducans* is a normal species whereas *omer-cooperi* is a variant species bearing only one pair of long epimeral setae. Before me, from Florida, is a species composed of both types collected the same day from the same host.

Like their distant relatives, the species of *Holopothrips*, males of *Phrasterothrips* have the lateral posterior pair of setae on abdominal tergum IX as long as the mid pair of setae.

The genus *Phrasterothrips* needs to be reanalyzed to learn its exact limits.

### Phthirothrips Priesner

*Phthirothrips* Priesner (1933c:154). Type species by original designation: *Phthirothrips pediculus* Priesner.

Small thrips with heavy, broadly rounded mouth cones, small third antennal segment, and, in North American species, only seven segments in the antenna.

*Head.* Short (Fig. 39); eyes, dorsally, composed of a few large facets; antennae inserted forward of the anterior eye margin, seven-segmented, segment II with sensorium positioned toward the apex, segment III very small, probably without sense cones; postocular setae well developed.

*Mouth parts.* Mouth cones large, broadly rounded; slender maxillary stylets only slightly retracted into the head.

*Thorax.* Pronotum usually proportionately large in brachypterous forms.



*Abdomen.* Pelta of brachypterous forms may be divided into three parts.

Only five species of *Phthirotirips* are known to exist. Of these, the Floridian *morgani* is the sole known North American form; the others are found in Liberia and Brazil. *Phthirotirips morgani* differs from all its congeners except the Brazilian *nemoralis* by the characteristic form of the antenna which has morphological segments VII and VIII completely fused, without a trace of a partial suture between them. In the other species antennal segments VII and VIII may be compactly united but always there is either a complete suture or a partial suture present to mark their division. From *nemoralis* the species *morgani* differs in several ways enumerated by Hood (1954a:25).

*Phthirotirips* is suggestive of *Lissothrips*. Both *Lissothrips* and *Phthirotirips* have small third antennal segments; both often have incomplete prothoracic epimeral sutures, both have praepectal plates in the neck region, and most of the species feed in or around mosses and lichens. *Williamsiella*, another of the *Lissothrips*-like genera, which also is found around mosses, is perhaps the closest relative of *Phthirotirips*. In North America *Williamsiella* differs from *Phthirotirips* most noticeably in that in *Williamsiella* the sensorium of antennal segment II is positioned near the center of that segment and the pelta is but a single large plate.

Generally these thrips are apterous and confined to the tropics. According to Priesner (1933c), the winged forms lack accessory fringe cilia on the fore wing. If fusion of antennal segments, complete apterism, and loss of sense cones on the third antennal segment is indicative of evolutionary specialization, then *morgani* is the most specialized member of the genus. Since the others are restricted to the true tropics, *morgani* is further different or specialized in that it has advanced through the tropical belt into the periphery of the warm temperate zone.

#### **Plectrothrips Hood**

*Plectrothrips* Hood (1908a:307). Type species by monotypy: *Plectrothrips antennatus* Hood.

*Plectothrips* Moulton (1911:31). Misspelling of *Plectrothrips*.

Tubulifera with the sclerotized portion of the pronotum reduced to a median shield.

*Head.* Smooth (Fig. 43); antennae inserted on the ventral surface of the head; antennal segment II with sensorium positioned toward the base.

*Mouth parts.* Mouth cones short, broadly rounded; slender maxillary stylets retracted far into the head, varying in position from fairly close together to very far apart within the head.



*Thorax*. Pronotum reduced to a shield that does not extend to the sides and which is generally surrounded by a membrane-like area (Fig. 43); praepectus usually absent; mesopraesternum reduced; fore wings moderately wide.

*Abdomen*. Pelta large (Fig. 21); tergum of segment II membrane-like at the sides; tube stout, sometimes ridged.

*Larvae*. Posterior margin of abdominal segment IX extended into spur-like projections.

It seems reasonable to believe that the somewhat degenerate *Plectrothrips* was derived from the closely related *Eurytrichothrips*. Both genera have the same general shape and details of structure. Unlike the exotic genus *Eurytrichothrips*, *Plectrothrips* has a reduced pronotal shield and the mesopraesternum is reduced or absent.

Some species of this genus have a more or less ridged tube similar to *Sophiothrips*. Because of the wide pelta, occasional retention of the praepectus, occasional ridged tube, and the lack of special adornments or unusual shape, *Plectrothrips* and *Eurytrichothrips* are probably close to *Sophiothrips*. In spite of the peculiarity of the reduced pronotum, *Plectrothrips* has not advanced far from the generalized tubuliferon.

World-wide in distribution, the genus *Plectrothrips* is known by species described from North and South America, the Greater Antilles, Africa, and islands in the Malayan region. Before me are several undescribed species from the Pacific islands of Guam and Iwo Jima. Their successful colonization of islands may be due to their habit of living in dead twigs which could float for considerable distances.

Five species have been discovered in North America.

<i>antennatus</i> Hood (1908a:370).....	Eastern U.S.A.
<i>debilis</i> Hood (1954b:285).....	Florida
<i>latus</i> Hood (1941:201).....	Panama
<i>longisetis</i> Hood (1941:199).....	Florida
<i>pallipes</i> Hood (1916d:78).....	Jamaica

### **Podothrips Hood**

*Podothrips* Hood (1913b:67). Type species by original designation: *Podothrips semiflavus* Hood.

As mentioned in the original description, this genus is closely allied to *Haplothrips*. Because of several minor but definite differences, *Podothrips* may be considered a separate entity of full generic rank.

Species of *Podothrips* in both sexes have the inner tips of the fore tibiae drawn out as spurs and the praepectal plates are greatly enlarged (Fig. 24). The combination of these two features will distinguish this genus from *Haplothrips* and from all other Tubulifera. Otherwise the characteristics of *Podothrips* are those given under *Haplothrips*. In cer-

tain minor features—the general appearance of the head, the wrinkles behind the eyes, and the widely spaced ocelli—*Podothrips* also resembles *Bagnalliella*.

So far only the type species, *semiflavus*, has been found in North America. It occurs on grasses in the West Indies and Florida.

### **Poecilothrips Uzel**

*Poecilothrips* Uzel (1895:264). Type species by monotypy: *Poecilothrips albopicta* Uzel.

*Cephalothripoides* Bagnall (1927:582). Type species by original designation: *Cephalothripoides harrisoni* Bagnall. Synonymized by Priesner (1949) and Pelikán (1950).

White-striped species of the subfamily Phlaeothripinae with long pointed mouth cones, with short postocular setae, with the mesosternum incut in the middle of the anterior margin, and with metanotum longitudinally striate.

*Head*. Elongate; eyes large, bean-shaped; postocular setae small to minute; many antennal segments bicolored light and dark.

*Mouth parts*. Mouth cones long and pointed; slender maxillary stylets retracted far into the head, touching within the center of the head.

*Thorax*. Metanotum longitudinally striate; praepectus absent; mesopraesternum slightly reduced; mesosternum emarginate in the middle of the anterior margin; fore wings moderately wide.

*Abdomen*. Pelta small, nearly triangular (Fig. 119); tube moderately long.

Probably only one species, of Holarctic distribution, represents this genus although four specific names are in the literature. Like many *Acanthothrips*, *Poecilothrips* has white lateral stripes along the dorsum of the body and long pointed mouth cones. Unlike *Acanthothrips*, however, the larvae do not have head horns. In its morphology and in its habit of living on the surface of dead branches, *Poecilothrips* is similar to *Acanthothrips* and is undoubtedly a side branch of the *Acanthothrips* stem.

Life history accounts of *Poecilothrips* were given by Bailey in 1931 and a detailed analysis of the species, *albopictus*, including its variation and life history, was published by Pelikán in 1950.

The names used for North American entities follow.

<i>dens</i> (Moulton), <i>Trichothrips</i> (1907:60) . . . . .	California
<i>albopictus</i> Uzel (1895:264) . . . . .	Holarctic
<i>lupini</i> Moulton (1929a:133)	
<i>ornatus</i> (Hood), <i>Phloeothrips</i> [ <i>sic</i> ] (1913a:165)	

### **Polyphemothrips Schmutz**

*Polyphemothrips* Schmutz (1909a:276). Type species by monotypy: *Polyphemothrips brasiliensis* Schmutz. New synonymy.

- (?) *Lathrobiothrips* Hood (1933c:421). Type species by original designation: *Lathrobiothrips ramuli* Hood. New synonymy?
- (?) *Diopsothrips* Hood (1933c:422). Type species by original designation: *Diopsothrips flavus* Hood. New synonymy?
- Adelothrips* Hood (1938c:380). Type species by original designation: *Adelothrips xanthopus* Hood. New synonymy.

A group of the Phlaeothripinae which in their greatest development attain fairly large size, having an elongated head with cheek pouches and a seven-segmented antenna, but which in their least development closely resemble *Phlaeothrips*. In the Americas there are more than forty species; most of them are tropical in distribution.

*Head.* Size varies from moderately rectangular to extremely long in length, with or without cheek pouches (Figs. 79, 80); surface usually hexagonally reticulate although sometimes only faintly so, and patterns upturned at the middle of the head; antenna seven- or eight-segmented, third segment somewhat elongated, usually sense cones long; ocellar setae occasionally well developed and long.

*Mouth parts.* Mouth cones broadly rounded to somewhat pointed (Fig. 7); maxillary stylets of the slender type but slightly broadened; maxillary palps generally large (Fig. 6).

*Thorax.* Major setae usually developed, sometimes long; prothoracic epimeral sutures complete; praepectus absent; praesternum fairly well developed to degenerate; fore wings broad.

*Abdomen.* Pelta small (Fig. 125); tube normal to somewhat thick.

First discovered in Brazil, this varied group has since been found in all except the cold regions of the Americas. It is also found in other parts of the world. The type species *brasiliensis* is large, but much smaller species such as *bratleyi* are now known.

Generally, although not always, cheek pouches are most prominent on those species with the greatest body length. This superdevelopment of a morphological area correlated with an increase in size suggests a type of heterogenous growth tendencies that has become fixed in the species.

Some of the smaller species of this genus closely resemble species of *Phlaeothrips*. Such species as *Polyphemothrips ambitus* or *bratleyi* are very little different from *Phlaeothrips angusticeps* or *anomocerus*. Principally, the tendency for fusion of the last two antennal segments and the large size of the maxillary palps are characteristics of *Polyphemothrips* and not those of *Phlaeothrips*. Usually, too, species of *Polyphemothrips* have the pattern of the head reticulations markedly upturned at the middle of the head.

Other groups with obvious *Polyphemothrips* affinity may be differentiated as full genera because their characteristics are so striking. One of these, the South American *Cordyllothrips* Hood (1937b), differs in that

it has only six segments in the antenna. It is a large thrips and has well-developed cheek pouches. Another genus, *Docessissophothrips* Bagnall (Fig. 81), resembles species of *Polyphemothrips* as, for example, *brasilensis*, except that the head is shorter and the maxillary stylets are greatly lengthened. The former genus also contains large thrips with well-developed cheek pouches.

Elsewhere (Stannard 1956a) I had kept *Adelothrips* as a genus separate from *Polyphemothrips*. Upon further study I now find that neither can be separated by characteristics so far recognized. The two, therefore, should be combined under the oldest name—*Polyphemothrips*.

The European genus *Abiastothrips* is a *Polyphemothrips*-like genus. In *Abiastothrips* the maxillary palps are smaller than in species of *Polyphemothrips* and by this feature the two may be separated.

- acutus (Stannard), *Adelothrips* (1956a:108)..... Illinois  
 ambitus (Hinds), *Trichothrips* (1902:191)..... Eastern U.S.A.  
 bicolor (Stannard), *Adelothrips* (1956a:109)..... Mexico  
 bipartitus (Hood), *Adelothrips* (1954b:281)..... Florida  
 bratleyi (Watson), *Trichothrips* (1935:61)..... Southeastern U.S.A.  
*flavus* (Moulton and Andre), *Hoplothrips* (1936:225)  
 brunneus (Hood), *Diopsothrips* (1933c:424)..... Panama  
 caribbeicus (Stannard), *Adelothrips* (1956a:109)..... Mexico, Florida  
 flavus (Hood), *Diopsothrips* (1933c:423)..... Panama  
 grandis (Stannard), *Adelothrips* (1956a:110)..... Mexico  
 hammockensis (Stannard), *Adelothrips* (1956a:111).... Florida  
 junctus (Hood), *Cryptothrips* (1912c:139)..... Eastern U.S.A.  
*quercus* (Moulton and Andre), *Hoplothrips* (1936:225)  
 louisianae (Hood), *Diopsothrips* (1936b:98)..... Louisiana  
 macrura (Hood), *Adelothrips* (1941:185)..... Cuba  
 pericles (Hood), *Adelothrips* (1938c:383)..... Florida  
 phaeura (Hood), *Adelothrips* (1941:183)..... Florida  
 ramuli (Hood), *Lathrobiotrips* (1933c:421)..... Panama  
 rubustus (Hood), *Adelothrips* (1954b:280)..... Florida  
 skwarrae (Priesner), *Symphyothrips* (1933c:146)..... Mexico  
 tibialis Hood and Williams (1915:136)..... Florida  
 xanthopus (Hood), *Adelothrips* (1938c:380)..... Florida

### Preeriella Hood

*Preeriella* Hood (1939:612). Type species by original designation: *Chirothripoides minutus* Watson.

Minute Tubulifera with antennal segment III small, cup-shaped, and broadly attached to segment IV, with fore wings exceptionally narrow, and body setae pointed or just slightly dilated at tips.

*Head*. Small without dorsal reticulations (Figs. 4, 44); antenna eight-segmented; segment III small, cup-shaped, broadly attached to segment IV; postocular setae long.

*Mouth parts*. Mouth cones broadly rounded; slender maxillary stylets retracted slightly into the head.



*Thorax.* Epimeral sutures incomplete, not attaining the posterior margins of the pronotum (Fig. 44); center of pronotum with a transverse ridge; praepectus strongly developed; pterothorax with a median ridge connecting the meso- and metafurcae; all tarsi probably one-segmented; fore wings extremely narrow, fringe cilia widely spaced, with no accessory cilia; major thoracic setae slightly dilated at tips.

*Abdomen.* Pelta in three parts (Fig. 101); tube short; lateral setae mostly pointed at tips.

*Preeriella* is most closely related to *Hydiorhrips*. The principal differences between the genera are in the head reticulations, the shape of the antennae, and the form of the major body setae.

Both of these genera are somewhat compressed laterally rather than dorsoventrally as in most other Tubulifera. They differ from other genera in their family in many ways, especially in the narrowed wings, the presence of a transverse ridge on the pronotum, the presence of a sternal ridge between the meso- and metafurcae, and in the form of the pelta.

Their habits are unknown. Those specimens of *Preeriella* that I have captured came from grass clumps in Chiapas, Mexico, or from woodland leaf litter in Arkansas and Illinois. Undoubtedly they are more common than generally realized but their small size and light color are factors that hinder easy detection. One species has been described from Florida. Specimens from other localities in the collections in the Illinois Natural History Survey may prove to be new species.

### Pristothrips Hood

*Pristothrips* Hood (1925b:61). Type species by original designation: *Pristothrips aptus* Hood.

*Celetothrips* Morgan (1929:1). Type species by original designation: *Celetothrips breviceps* Morgan. Synonymized by Hood (1938b).

Blackish thrips with large eyes and with a series of spurs on the fore tibiae.

*Head.* Elongate (Fig. 73); eyes large, positioned fairly close together, the interval between them less than the width of a compound eye; post-ocular setae small; basal cheek setae always represented by one or two enlarged, prominent pairs; intermediate antennal segments elongate, not typically vase-shaped.

*Mouth parts.* Mouth cones long and pointed; slender maxillary stylets retracted far into the head, meeting in the center of the head.

*Thorax.* Praepectus absent; mesopraesternum degenerate; metanotum occasionally with a posterior projection; fore femora with inner spurs; fore tibiae with a series of inner spurs; fore wings broad, fringe cilia closely spaced, accessory cilia present.

*Abdomen.* Pelta triangular; all segments slender; tube moderate in size.



*Pristothrips* may be considered a full genus because of the uniqueness of the form of the fore tibiae in combination with the large eyes. All species discovered so far have a series of spurs on the fore tibiae. In other respects *Pristothrips* resembles *Acanthothrips* and *Hoplandrothrips*. In *Pristothrips* the pelta is similar to that of *Acanthothrips coriaceus*, the eyes resemble those in *Acanthothrips itzanus*, and the presence of stout basal cheek setae is suggestive of species belonging to *Hoplandrothrips*.

The four known species are Neotropical. One species, *Pristothrips breviceps*, has been reported to be common in Central America south of the Isthmus of Tehuantepec. Possibly this species may produce living young (Hood 1938b).

### Pueblothrips Stannard

*Pueblothrips* Stannard (1950:143). Type species by original designation: *Pueblothrips minuta* Stannard.

Minute Tubulifera with short maxillary stylets that hardly retract into the head, antennal segment III just slightly longer than segment IV, a short mouth cone, and absence of praepectal plates.

*Head*. Short (Fig. 37); antennae inserted just beyond anterior eye margin, eight-segmented, segment III slightly longer than segment IV; postocular setae minute.

*Mouth parts*. Mouth cones short, broadly rounded; slender maxillary stylets barely retracted into the head.

*Thorax*. Major pronotal setae small, only the epimeral pair well developed; praepectus absent; mesopraesternum degenerate; fore wings somewhat narrowed, fringe cilia placed far apart.

*Abdomen*. Pelta seemingly small; tube short; anal setae shorter than the tube.

According to Professor Priesner, in correspondence, this genus is most closely related to two fossil genera, *Cephenothrips* and *Necrothrips*. Like *Antillothrips*, *Phthirothrips*, *Sophiothrips* and *Williamsiella*, *Pueblothrips* has short maxillary stylets. Unlike most of those genera, the mouth cone and postocular setae of *Pueblothrips* are extremely short. From *Sophiothrips*, *Pueblothrips* may be distinguished by the absence of praepectal plates.

The only known species was found in Puebla, Mexico.

### Rhopalothrips Hood

*Rhopalothrips* Hood (1912b:72). Type species by original designation: *Rhopalothrips bicolor* Hood.

Small brown and pale yellow thrips with prothoracic setae greatly dilated at the tips and with the pronotum warty.

*Head.* Short, fundamentally hexagonally reticulate but warty, with a median carina extending slightly between the antennae; ocelli absent; antennae eight-segmented, segment III small; segments VI, VII and VIII closely joined.

*Mouth parts.* Mouth cones pointed; maxillary stylets slender, retracted far into the head, spaced moderately far apart.

*Thorax.* Major setae of pronotum extremely dilated at tip; notum warty as in *Trachythrips*; praepectus absent; fore femora unarmed in both sexes.

*Abdomen.* Pelta moderate in size; tube short.

*Rhopalothrips* is remarkably similar to *Idiothrips* and its various subgroups. All have warty markings on the head and thorax. *Rhopalothrips* differs mostly in that the prothoracic setae are enormously dilated. Another relative, *Scopaeothrips*, which also has greatly dilated prothoracic setae lacks warts on the head and thorax and by this feature the two are easily separated.

Only one species of the genus, *Rhopalothrips bicolor*, occurs in North America where it often causes damage to prickly pear cactus. Most likely this thrips is native to North America as is the *Opuntia* cactus host. It seems unlikely that *Opuntia* picked up this pest from another part of the world when the cactus was introduced to Spain and the Mediterranean regions. Bailey (1942) has given an account of the biology of *Rhopalothrips bicolor*.

### **Scopaeothrips Hood**

*Scopaeothrips* Hood (1912b:70). Type species by original designation: *Scopaeothrips unicolor* Hood.

Small, dark thrips with prothoracic setae greatly dilated at the tips, and the pronotum closely transversely striate and not warty.

*Head.* Short, predominantly transversely striate (Fig. 45); ocelli borne on a prominence between the eyes; antenna eight-segmented, segment VII pedicellate and not closely joined to segment VI as in the case in *Rhopalothrips*.

*Mouth parts.* Mouth cones pointed; maxillary stylets slender, parallel to V-shaped within the head.

*Thorax.* Major setae of pronotum extremely dilated at tip; striae of pronotum in part transverse and in part forming concentric circles. Metanotum longitudinally striate; praepectus absent; males with a large basal tooth on the inner side of the fore femora (Fig. 14).

*Abdomen.* Pelta moderate in size (Fig. 105); tube short.

This genus has several representatives. One species, *unicolor*, occurs

on cactus in southwestern U.S.A., and several species occur in Japan and New Caledonia. Most specimens encountered are brachypterous.

*Scopaeothrips* is closely related to *Rhopalothrips*. Although similar to each other in many ways, they may be distinguished by the type of sculpture of the pronotum and by the form of the antennae. Seemingly, *Scopaeothrips* is more primitive than *Rhopalothrips*.

### *Sedulothrips* Bagnall

*Sedulothrips* Bagnall (1915b:503). Type species by subsequent designation of Moulton (1933): *Sedulothrips insolens* Bagnall.

Holoptic Tubulifera with small decumbent spines on the pelta and without greatly enlarged cheek warts.

*Head*. Elongate, slightly arched; cheeks without enlarged warts; eyes large, nearly touching at the posterior dorsal angles; antennae inserted on the ventral surface of the head, intermediate segments vasiform; postocular setae short.

*Mouth parts*. Mouth cones extremely long and pointed; slender maxillary stylets retracted far into the head, touching within the center of the head.

*Thorax*. Metanotal markings intermediate between longitudinal striae and hexagonal reticulations; praepectus absent; fore wings fairly narrow, with closely spaced fringe cilia, usually dark in color.

*Abdomen*. Pelta small, with decumbent spines on the posterior reticulations (Fig. 134); tube moderate in size; anal setae about twice as long as tube.

Only *Sedulothrips* and *Eupathithrips* have decumbent spines on the pelta. *Sedulothrips* which lacks cheek warts can be recognized easily from *Eupathithrips* which has large cheek warts.

Since Bagnall's description of this genus, most thysanopterists have concluded that *insolens* was Bagnall's choice of a type species. Such is not the case, however, for Bagnall included two species, *insolens* and *vigilans*, neither of which was designated type. Apparently Moulton in 1933 was the first to make a type species selection.

Species of *Sedulothrips* have unusually large eyes that nearly touch at their front and rear corners on the dorsum of the head. This holoptic condition is somewhat approached in *Holopothrips* and *Eupathithrips* and exceeded in *Macrophthalmothrips*; even *Neurothrips* and some species of *Acanthothrips* exhibit tendencies toward close spacing of the eyes.

As in the closely related *Acanthothrips*, many species of *Sedulothrips* have white markings or blotches on segments of the abdomen. *Macroph-*

*thalmothrips* which has eyes touching on the dorsum also has white markings, but in species of the latter genus the white extends onto the head and thoracic regions.

One species, *S. hubbelli*, occurs as far north as Honduras; the other four known species are found to the south in Panama, Trinidad, and Brazil.

<i>hubbelli</i> Watson (1923:76) .....	Honduras
<i>tristis</i> Hood (1933c:434) .....	Panama
<i>vigilans</i> (Hood), <i>Polyommatothrips</i> (1913c:123) .....	Panama

### **Sophiothrips Hood**

*Sophiothrips* Hood (1933c:425). Type species by original designation: *Sophiothrips squamosus* Hood.

*Nanothrips* Faure (1938:3). Type species by original designation: *Nanothrips breviceps* Faure. Synonymized by Hood (1954b).

Small Tubulifera with short maxillary stylets, with antennal segment III equal to or larger than segment IV in width and length, and with praepectal plates.

*Head*. Short (Fig. 38); antennae inserted on the ventral surface of the head, segments VII and VIII often partially fused; antennal sense cones, in winged forms at least, extremely long; postocular setae small.

*Mouth parts*. Mouth cones blunt but not broadly rounded; slender maxillary stylets barely retracted into the head.

*Thorax*. Praepectus present (Fig. 12); mesopraesternum usually well developed; fore wings fairly broad, slightly indented in the middle.

*Abdomen*. Pelta broad (Figs. 103, 104); tube often thick, often ridged; anal setae extremely short.

Several distinct forms are often found in the species of this genus. If the species had but one form—the long-winged, heavily reticulated form—the genus could be defined easily on the basis of the extremely long antennal sense cones which extend forward and curve down and around the next segment. However, the nearly wingless forms and some long-winged, weakly sculptured forms may have shorter sense cones which do not differ from the type found in other genera.

Common to all species and forms of *Sophiothrips* is the characteristic of the slender maxillary stylets that hardly retract into the head. Only a few other genera have similarly formed stylets. From those genera, *Sophiothrips* may be distinguished either by the larger size of antennal segment III or by the broad pelta.

There are some nine known species in this genus; of these, the following occur in the New World.

<i>bicolor</i> Watson and Preer (1939:1) .....	Florida
<i>panamensis</i> Hood (1933c:428) .....	Panama



spadix Hood (1954b:282).....	Florida
squamosus Hood (1933c:426).....	Panama
unicolor Hood (1939:597).....	Texas
vorticatus Hood (1954b:283).....	Florida

### Stictothrips Hood

*Stictothrips* Hood (1924b:295). Type species by original designation: *Phloeothrips* [sic] *maculatus* Hood.

*Neurothrips*-like, but with hexagonal reticulations on the fore wings.

This genus is composed of species having close affinities with *Neurothrips*. In fact, in the species of *Stictothrips* the general structure and color is almost identical to that found in the species of *Neurothrips*.

*Stictothrips* is distinctive because of the broader wings which are covered by hexagonal reticulations and by the shorter anal setae, each of which is hardly more than two times the length of the tube. By contrast, *Neurothrips* is characterized by the narrower wings which are without well-formed hexagonal reticulations and by the longer anal setae which are longer than two and one-half times the length of the tube.

So far, three species have been discovered. Professor Priesner described the Egyptian *leopardinus* and Professor Hood described the South African *faurei* and the North American *maculatus*. The latter species occurs in the eastern part of the United States.

### Symphyothrips Hood and Williams

*Symphyothrips* Hood and Williams (1915:131). Type species by original designation: *Symphyothrips punctatus* Hood and Williams.

This genus has all the characteristics of *Polyphemothrips*, including the enlargement of the maxillary palps and the partial fusion of antennal segments VII and VIII. The only structural feature that distinguishes *Symphyothrips* from *Polyphemothrips* is the shape of the tube. In *Symphyothrips* the tube is greatly enlarged and slightly warty (Fig. 35), whereas in *Polyphemothrips* the tube is slender or moderately thickened and never warty.

The sole species of *Symphyothrips*, *punctatus*, has six pairs of black abdominal spots, a color characteristic which should serve to distinguish it at a glance. This species occurs in Panama, the West Indies, and Florida.

### Teuchothrips Hood

*Teuchothrips* Hood (1919b:86). Type species by original designation: *Teuchothrips simplicipennis* Hood.

In my opinion the genus *Teuchothrips* is a derivative of *Horistothrips*, both of which in turn have been derived from an ancestor that was



common to *Plectrothrips* as well. I base this supposition on the fact that these genera have large platelets rather than small stippled areas on the prosternum, and that these genera have other similar features and tendencies. Most definitely the Australian *Teuchothrips* and its allies are not *Liothrips*-like, a genus which they resemble only superficially. It is doubtful, indeed, that any representative of *Teuchothrips* occurs in the New World.

I believe that the Mexican *Teuchothrips pithecolobii* Hood should be transferred to *Liothrips* or a *Liothrips*-like genus. Hood related *pithecolobii* to *pittosporicola*. Although I have not seen *pithecolobii* I have seen specimens of *pittosporicola*, a species which is similar to *parvus* (Karny) but not to the type species of *Teuchothrips*, *simplicipennis*. Professor Priesner has told me he intends eventually to place *parvus* in a new genus. If it is worth while to separate *parvus* from *Teuchothrips* it would be equally worth while to take out *pittosporicola* as well as its relatives.

Because so many diverse species need to be considered before this genus can be properly understood, I have made no attempt herein to redefine *Teuchothrips* or include it in the key on the basis of my limited studies. The late Mr. Moulton informed me that his species, *Hoplothrips mexicanus*, is the same as *pithecolobii*.

#### Thorybothrips Priesner

*Thorybothrips* Priesner (1924b:540). Type species by original designation: *Thorybothrips graminis* Priesner.

Once seen, this genus can be easily recognized again. On the other hand the subtlety of its characteristics is such that it is difficult to key or to define.

Perhaps the most conspicuous feature that can be used to identify the genus is the head shape (Fig. 55), which is somewhat elongate and drawn out beyond the eyes. The head shape, in combination with the characteristics of the slender maxillary stylets which touch each other in the center of the head, the triangular pelta, the broad nonindented fore wings, and the degenerate type of mesopraesternum should be sufficient to permit the differentiation of this genus from all other North American thrips.

Only Moulton's species *yuccae* occurs in North America. It was described in 1929 from a Texas specimen.

#### Treherniella Watson

*Treherniella* Watson (1923:81). Type species by original designation: *Haplothrips orlando* Watson and Osborn.

*Gomphiothrips* Moulton (1933b:403). Type species by original designation: *Gomphiothrips tibouchinae* Moulton. Synonymized by Priesner (1949).

Like *Thorybothrips*, *Treherniella* is difficult to characterize and to key.

The single species in North America is *Haplothrips*-like in general appearance, except for the shape of the wings. In *Treherniella* the fore wings are broad and straight, whereas in *Haplothrips* the fore wings are narrower and usually indented in the middle.

I do not know where to place *Treherniella*. It is a group of the Phlaeothripinae and not near *Gastrothrips* or *Cryptothrips* as Watson suggested. Perhaps *Treherniella* might belong near *Thorybothrips*. In each of these genera, the fore margin of the mesonotum is broken into small stippled platelets, the mesopraesternum is similarly degenerate, and the pelta is triangular.

It is possible that the characteristic of the bulge at the base of the fore wings, somewhat suggestive of the condition found in the exotic species of *Trybomiella*, may prove to be a reliable point for the recognition of *Treherniella*.

Hood in 1931 subordinated the name *orlando* Watson and Osborn under Morgan's earlier name, *amplipennis*. All of the specimens known to me were taken in Florida.

#### Trichinothrips Bagnall

*Trichinothrips* Bagnall (1929:604). Type species by original designation: *Trichinothrips branderi* Bagnall.

The first species of this genus, *Trichinothrips pusillus* Hood, was reported to be in North America by Hood in 1954. I have never seen that species which was found in Florida.

The type species, *branderi*, is a Ceylonese species which has the following characteristics of diagnostic value: (1) antennal segments VII and VIII partially fused, (2) each of the midlateral setae of the prothorax moved forward close to the anterolateral seta, (3) the mesopraesternum seemingly fused to the mesosternum proper.

Like *Holopothrips*, the males of *Trichinothrips* have the lateral posterior pair of setae on abdominal tergite IX equal in length to the mid pair.

In my opinion *Trichinothrips* is the Oriental equivalent of *Phrasterothrips*, and possibly neither genus is pantropical, opinions to the contrary in the literature notwithstanding.

#### Trisclerothrips Stannard

*Trisclerothrips* Stannard (1953:1). Type species by original designation: *Trisclerothrips hurricaneus* Stannard.

Tubulifera with the slender maxillary stylets retracted far into the

head, antenna seven-segmented, antennal segment III exceptionally small, and the pelta divided into three parts.

*Head.* Longer than in *Lissothrips*; eyes moderate in size in the micropterous forms; antennae inserted on the ventral surface of the head, segment III smaller than either segment II or IV, morphological segments VII and VIII fused; postocular setae well developed.

*Mouth parts.* Mouth cones pointed; slender maxillary stylets retracted far into the head, touching in the center of the head.

*Thorax.* Epimeral sutures incomplete; praepectus present; mesopraesternum fairly well developed.

*Abdomen.* Pelta divided into three parts (Fig. 110); tube short.

This genus seems most closely related to *Lissothrips*. From *Lissothrips* it may be distinguished by the complete fusion of morphological segments VII and VIII of the antenna, and by the divided pelta.

Only one species, from Jamaica, is shown.

### Trybomia Karny

*Trybomia* Karny (1911a:503). Type species by original designation: *Trybomia phasma* Karny.

*Ommatothrips* Hood (1915a:32). Type species by original designation: *Ommatothrips gossypii* Hood. Synonymized by Moulton (1933a).

Large black thrips with elongated heads, with slender maxillary stylets, with long ocellar setae, with ventral surface of eyes greatly prolonged posteriorly, and with the intermediate antennal segments obliquely truncate at both base and apex. These tropical thrips have been found in Mexico and Honduras in North America, as well as in several countries in South America. The characteristics mentioned herein do not always apply to the South American species.

*Head.* Elongate (Fig. 53); eyes fairly large and greatly produced posteriorly on the ventral surface; antenna eight-segmented, intermediate segments obliquely truncate at base and at apex; ocellar setae exceptionally long; surface of head weakly transversely striate.

*Mouth parts.* Mouth cones pointed; maxillary stylets slender, moderately close together but not touching within the head; maxillary guide arms not fused to stylets; maxillary palps large.

*Thorax.* Praepectus absent; mesopraesternum well developed; anterior margin of mesosternum shortened; metanotum weakly hexagonally reticulate; hind tibiae with basal sensory hair longer than apical sensory hair; fore wings broad with fringe cilia placed fairly close together and with accessory cilia.

*Abdomen.* Pelta small, triangular; tube moderately short; heavy body spines often somewhat wavy; males apparently without glandular areas.

Superficially this genus resembles some members of the Megathripinae such as *Elaphrothrips*. Besides similar general appearance both genera have well-developed mesopraesterna and short anterior mesosternal borders. Most likely these are characteristics that have developed in parallel because the two genera are not on the same phyletic line.

*Trybomia* is probably a near relative of *Liothrips*: At the same time *Trybomia* also has many features suggestive of *Haplothrips*, particularly that complex formerly called *Leptothrips*. Because the species of *Trybomia* lack praepectal plates and have broad, nonindented fore wings, it is seemingly better to place them nearer *Liothrips* which has these same characteristics than near "*Leptothrips*" which has praepectal plates and indented wings. The species of *Trybomia* could be considered as giant *Liothrips*.

If *Ophthalmothrips* really is a true Megathripinae, then both *Ophthalmothrips* and *Trybomia* are remarkable examples of genera that have converged in their evolutionary development. From the literature it would appear that these genera are closely related. Nevertheless, until it can be learned whether *Ophthalmothrips* has broad maxillary stylets or slender stylets it seems best to defer consideration of the problem.

Only one species has been recorded from North America. Moulton in 1929 described *brevitubus* from Mexico (see Bailey 1949:131).

#### Williamsiella Hood

*Williamsiella* Hood (1925b:60). Type species by original designation: *Williamsiella bicoloripes* Hood.

Small, dark Tubulifera with short maxillary stylets barely retracted into the head, the sensorium of antennal segment II located near the middle of that segment, and having a short third antennal segment.

*Head*. Short (Fig. 40); eyes small, composed of but a few large facets; antenna seven-segmented, morphological segments VII and VIII completely fused, segment III shorter than segment IV and much narrower; postocular setae exceptionally long.

*Mouth parts*. Mouth cones long, broadly rounded; slender maxillary stylets hardly retracted into the head.

*Thorax*. Epimeral sutures incomplete; praepectus present; mesopraesternum degenerate; only apterous forms known.

*Abdomen*. Pelta broad, separated by a wide membrane-like area from the anterior edge of segment II (Fig. 100); tube short; anal setae short.

Perhaps the closest relative of this genus is *Phthirotrips* which *Williamsiella* resembles by reason of the heavy mouth cones and the short third antennal segment. These two genera can be differentiated by the position of the sensorium on antennal segment II. In *Phthirotrips*



this sensorium is placed near the apex of segment II, whereas in *Williamsiella* the sensorium is located nearer the center of segment II. A similar, related, undescribed genus with each antenna eight-segmented occurs on Ponape Island in the Pacific.

Before me are unidentified specimens from Trinidad, Mexico, Georgia, and Florida. No species has been recorded from North America in previous literature.

### **Zaxenothrips** Crawford, J. C.

*Zaxenothrips* Crawford, J. C. (1943:221). Type species by original designation: *Zaxenothrips peculiaris* Crawford, J. C.

Small, dark thrips with maxillary stylets barely retracted into the head, without praepectal plates, and with antennal segment III just slightly longer than segment IV.

*Head.* Short (Fig. 41); eyes in the apterous forms, at least, small with 12 to 14 facets exposed dorsally; antennae seven-segmented, morphological segments VII and VIII partially divided by an incomplete ventral suture, antennal segment III slightly longer than IV; postocular setae conspicuous but short; cheeks with a wartlike protrusion just behind the eyes.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets slender, hardly retracted into the head.

*Thorax.* Major prothoracic setae conspicuous but short; epimeral sutures complete; praepectus absent; mesopraesternum degenerate or obliterated; fore tarsus armed with an inner tooth.

*Abdomen.* Pelta considerably detached from posterior margin; tube short, finely ridged.

*Zaxenothrips* is a group of thrips of striking over-all appearance, yet despite its obvious unusual total form the individual characteristics are not too far different from those found in other related genera. To make matters more difficult, it and its relatives such as *Williamsiella*, *Phthirotrips*, and *Sophiethrips* have much dimorphism and each type must be compared separately. A comparison of their usual characteristics, not characteristics of certain unique stages, shows that they differ from each other only in minor ways. Perhaps when more material can be assembled and studied, including all of the forms of all of the species involved, it might be found that it would be feasible to combine several of these genera into one. Hood (1954b) subordinated *Zaxenothrips* under *Sophiethrips*, an action with which I do not concur at the moment.

Only one species, *peculiaris*, has been described in *Zaxenothrips*. It occurs in Maryland. In the apterous stage it can be readily separated from all other Tubulifera with short maxillary stylets by the form of



the pelta and by the absence of praepectal plates. I have not had an opportunity to study the macropterous female which may or may not have the same key characteristics.

### Zaliothrips Hood

*Zaliothrips* Hood (1938c:386). Type species by original designation: *Zaliothrips citripes* Hood.

This genus is another of the several genera from Florida unknown to me. Apparently there are only a few specimens in existence and these are all kept in Hood's private collection, a collection I have not seen. According to Hood (1938c) *Zaliothrips* is characterized by having each antenna seven-segmented and by bearing resemblances to *Liothrips* and *Haplothrips*.

Two species are reported from North America.

*abdominalis* Hood (1954b:284) ..... Florida  
*citripes* Hood (1938c:387) ..... Florida

### SUBFAMILY MEGATHRIPINAE KARNY 1921

Generally large Tubulifera which have the maxillary stylets broad and bandlike, whose males always lack abdominal glandular areas and never have the lateral pair of posterior setae on abdominal tergite IX spinelike or shorter than in the female.

### Actinothrips Bagnall

*Actinothrips* Bagnall (1909:332). Type species by original designation: *Actinothrips longicornis* Bagnall.

Thrips of the subfamily Megathripinae lacking praepectal plates, with the anterolateral prothoracic setae placed well behind the anterior margin close to the midlateral setae, the prothoracic epimeral suture complete or nearly complete, the mesopraesternum degenerate, and only one pair of enlarged dorsal head setae.

*Head.* Elongate, profile much as in *Elaphrothrips*, transversely striate, with two strong, widely separated, heavy spines on each cheek; fore ocellus placed far anteriorly between the antennal sockets; antennal segments I each with a long differentiated seta; intermediate antennal segments greatly elongated; postocular setae long and heavy; mid-dorsal setae small.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets placed in V-shape within the head.

*Thorax.* Midlateral and anteromarginal setae of the prothorax small, rest of major pronotal setae longer, anterolateral setae placed close to midlateral setae; prothoracic epimeral sutures complete or nearly com-

plete; praepectus absent; mesopraesternum degenerate; metanotum with a pair of heavy setae located medially; many leg setae extremely long; wings moderate in size with a heavy transverse ridge running nearly the full length of each wing; males occasionally with large fore tarsal teeth; females apparently unarmed.

*Abdomen.* Pelta broad; segment VIII of males with a pair of lateral toothlike projections varying from minute in size to distinct projections similar to those in *Hybridothrips*; other abdominal male projections like those found in *Bactrothrips*, *Megalothrips*, *Eidothrips*, etc., not present; tube long and hairy.

*Actinothrips* superficially resembles *Elaphrothrips* and *Anactinothrips* but is not closely related to either of them. Species of *Actinothrips* lack praepectal plates and in each the mesopraesternum is degenerate. In sharp contrast all species of *Elaphrothrips* and *Anactinothrips* bear praepectal plates and in each the mesopraesternal sclerite is well developed and somewhat boat-shaped.

Actually *Actinothrips* is closely related to *Zeugmatothrips*, *Zeuglothrips*, *Megalothrips*, *Atractothrips* and several more North American genera, as well as to Oriental or African genera such as *Bactrothrips*, *Holurothrips*, *Kleothrips*, and many others. All these groups are members of the *Actinothrips* phyletic spur which is characterized primarily by the spacing of the anterolateral setae close to the midlateral setae of the prothorax and by the tendency of the males to bear abdominal projections.

Eight species have been described in this genus. Tropical in habitat, five species occur in South America; the Panamanian *trichaetus* Hood is the sole representative in North America. These six species may be the only ones that are rightfully assignable to the genus. Another two species occur in Africa; but, as pointed out by Bagnall (1936), these African species, *ritchianus* and *hargreavsi*, may not belong to *Actinothrips*. Almost certainly, *ritchianus* Bagnall should be eliminated or classified separately in a subgroup because it has a well-developed mesopraesternal plate that shows no signs of degeneration.

In 1935 Hood reviewed the species that had been described up to that time. He reported that they usually live in the folds of dead leaves and feed upon fungus spores. His further statement that they give birth to active young rather than lay eggs apparently is not true in all instances. Miss Kellie O'Neill, in correspondence (1953), commented that one species, at least, does lay eggs.

#### *Allothrips* Hood

*Allothrips* Hood (1908a:372). Type species by monotypy: *Allothrips megacephalus* Hood.

*Bryothrips* Priesner (1925a:2). Type species by original designation: *Bryothrips pillichellus* Priesner. New synonymy.

Small members of the Megathripinae with reduced eyes located on the anterior margin of the head, with each antenna seven-segmented, and with tube short.

*Head.* Moderate in size; smooth (Fig. 95); eyes reduced, composed of but a few facets, located on the anterior region of the head; antenna seven-segmented, morphological segments VII and VIII completely fused.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets broad, bandlike, retracted far into head, spaced fairly far apart and parallel or placed in V-shape in the head.

*Thorax.* Praepectus absent to faint; mesopraesternum degenerate or absent; notum without strong reticulations; tarsi each two-segmented; femora usually with several dilated setae; usually apterous, rarely brachypterous, never macropterous as far as is known.

*Abdomen.* Pelta broad, only posterior margin with reticulations (Fig. 139); tube short.

These thrips superficially resemble *Neothrips*, which belongs to another subfamily, the Phlaeothripinae, characterized by slender maxillary stylets. Besides the slender stylets, the lateral position of the eyes and the presence of a suture between antennal segments VII and VIII further differentiate *Neothrips* from *Allothrips*.

*Allothrips* is closely allied to *Pseudocryptothrips*. *Pseudocryptothrips* differs principally by having an eight-segmented antenna, not seven-segmented as in *Allothrips*. Furthermore, in *Allothrips* the area behind the eyes is not depressed, although in *Pseudocryptothrips* it is (Figs. 94, 95).

Actually, despite its more degenerate condition, *Parallothrips* is the closest relative of *Allothrips*. In *Parallothrips* all of the tarsal segments have fused into one, whereas in *Allothrips* the mid and hind tarsi are each two-segmented, the primitive condition.

*Allothrips*, as far as is known, is most abundant in Mexico north of the Isthmus of Tehuantepec and in the Lower Austral region of the United States. One species has progressed northward at least to Michigan. Another species has dispersed to the West Indies. It is possible, of course, that when more extensive collections have been made, South America also may contain species of this genus. Other species occur in Europe, South Africa, and the East Indies.

There are four North American species and several subspecies.

aureus	Stannard (1955b:155)	.....	California
megacephalus	Hood (1908a:373)	.....	Eastern U.S.A.
nubillicauda	Watson (1935:60)	.....	Southeastern U.S.A.

- watsoni watsoni* Hood (1939:600).....Southern Florida, Haiti  
*watsoni biminianus* Stannard (1955b:155).....Bahama Islands  
*watsoni acutus* Stannard (1955b:154).....Mexico  
*watsoni mexicanus* Stannard (1955b:154).....Mexico

### *Anactinothrips* Bagnall

*Anactinothrips* Bagnall (1909:329). Type species by original designation: *Anactinothrips meinerti* Bagnall.

*Ophidothrips* Schmutz (1909a:273). Type species by monotypy: *Ophidothrips handlirschii* Schmutz. Synonymized by Moulton (1933b).

*Lophothrips* Karny (1911a:503). Type species by original designation: *Lophothrips antennatus* Karny. Synonymized by Moulton (1933b).

Large, *Elaphrothrips*-like thrips with praepectal plates, a well-developed mesopraesternum which is wider than in *Elaphrothrips*, and an extremely long pair of metanotal setae as in *Actinothrips*.

*Head*. Elongate, similar in appearance to *Elaphrothrips*; anteocellar, postocular and mid-dorsal setae long; several pairs of cheek setae often large; intermediate antennal segments, elongate.

*Mouth parts*. Mouth cones broadly rounded; maxillary stylets broad, placed in V-shape to parallel within the head.

*Thorax*. All major setae well developed, anterolaterals placed far forward, not close to laterals as in *Actinothrips*; praepectus present; mesopraesternum well developed, boat-shaped, wider than in *Elaphrothrips*; metanotum with a pair of long setae as in *Actinothrips*; fore tarsus of major males, at least, armed with a large tooth.

*Abdomen*. Pelta broad; tube long, usually not hairy.

So far, a dozen species have been described in this genus and all of them occur in South America. I have seen a female specimen of an undetermined species from Panama, as well as the holotype of the Venezuelan type species which is deposited in the British Museum (Natural History).

Most definitely *Anactinothrips* is closely related to *Elaphrothrips* by all features. Because its mesopraesternum is wider, a presumed primitive characteristic, *Anactinothrips* could be considered a generalized member of the *Elaphrothrips-Idolothrips* complex. On the other hand, *Actinothrips* is not closely related to *Anactinothrips* as pointed out in the comments under the former genus, statements by other workers to the contrary notwithstanding.

### *Atractothrips* Hood

*Atractothrips* Hood (1938a:27). Type species by original designation: *Atractothrips bradleyi* Hood.

Long-tubed, warty thrips of large size belonging to the Megathripinae.



The sole species lives in dead cabbage palm leaves in southern Florida and the Florida Keys.

*Head.* Greatly elongate, with surface covered with warts (Fig. 97); eye region slightly bulged from head; region of head bearing antennae prolonged forward; intermediate antennal segments long; postocular setae short; cheek setal sockets enlarged.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets retracted far into the head, positioned fairly far apart, nearly parallel when at rest.

*Thorax.* Epimeral sutures complete to nearly complete, although the posterior parts of these sutures become very faint; praepectus absent; mesopraesternum degenerate; leg setae often arising from raised sockets; fore wings narrow, fringe cilia closely spaced, without accessory cilia.

*Abdomen.* Pelta broad; tube exceptionally long, curved, somewhat reticulate, not hairy; lateral abdominal setae often borne on projections.

Most likely this genus is a distant relative of *Actinothrips*. Neither of these genera bear praepectal plates, an unusual condition for members of the Megathripinae. Other undescribed relatives of *Atractothrips* occur in Australia and the Pacific Islands and even the Hawaiian *Dermothrips* is related, although not closely. *Leeuwenia*, a long-tubed specialized member of the Phlaeothripinae superficially resembles *Atractothrips* by parallel- and not by direct-line evolutionary development.

I have found these sluggish thrips in dead cabbage palm leaves on the Florida Keys and in the Everglades. Originally Professor J. C. Bradley took them from a similar habitat near Tampa, Florida. Only the type species is known.

### **Barythrips Hood and Williams**

*Barythrips* Hood and Williams (1915:134). Type species by original designation: *Barythrips sculpticauda* Hood and Williams.

Probably this genus belongs to the Megathripinae and possibly should be placed between *Pygothrips* and *Nesothrips*, especially that part of *Nesothrips* that was formerly called *Gastrothrips*.

I have never seen the type species, *sculpticauda*, a species based upon a single specimen from Florida. However, I have seen a damaged specimen that might belong in the genus from Big Pine Key, Florida, and the cotypes of *Barythrips grandicauda* Priesner (1925b), labeled "Frauenfeld" which may be a locality in northeastern Switzerland. Both of the species that I examined belong to the Megathripinae, but because all the specimens were in poor condition I cannot be certain that both were necessarily congeneric. In 1925, Hood added to the genus—but not to his complete satisfaction—the West Indian species, *heterocerus*, and



Watson in 1923 transferred his Floridian species, *Trichothrips brevitubus*, to *Barythrips*.

Because I do not know the type species I am unable to define the genus nor satisfactorily place it in a key.

### **Ceuthothrips Hood**

*Ceuthothrips* Hood (1938c:406). Type species by original designation: *Ceuthothrips timuqua* Hood.

This is another of those several monobasic genera from Florida that is not known to many thysanopterists, nor is it known to me. It is reasonable to surmise that this genus is a member of the Megathripinae because Hood originally related *Ceuthothrips* to *Diceratothrips*, which is a member of the Megathripinae.

No attempt was made to include *Ceuthothrips* in the key.

### **Cryptothrips Uzel**

*Cryptothrips* Uzel (1895:228). Type species by subsequent designation of Hood (1916b): *Cryptothrips lata* Uzel.

Black thrips with rectangular-shaped head, broad maxillary stylets which nearly touch each other within the center of the head, and with nonhairy tube.

*Head*. Elongate, rectangular (Fig. 88); eyes small; ocellar setae sometimes long; intermediate segments moderately long, less than twice as long as segment II.

*Mouth parts*. Mouth cones broadly rounded; broad maxillary stylets retracted far into the head, usually touching within the center of the head.

*Thorax*. Epimeral sutures usually complete; praepectus present but sometimes greatly reduced; mesopraesternum somewhat degenerate; fore wings broad, fringe cilia closely spaced.

*Abdomen*. Pelta (Fig. 143); tube moderately long, not hairy.

*Cryptothrips* is one of the few genera in the Megathripinae in which the maxillary stylets nearly touch each other within the head.

Close relatives of *Cryptothrips* in North America are *Nesothrips* and *Diceratothrips*. Other genera, especially in the Oriental and Australian regions, such as *Heptathrips* and *Cladothrips*, may be even more closely related to *Cryptothrips*. Neither *Nesothrips* nor *Diceratothrips* has closely positioned maxillary stylets within the head as do *Cryptothrips* and *Heptathrips*.

Unfortunately, all sorts of species have been assigned to *Cryptothrips*. Probably there are less than a half dozen species of true *Cryptothrips* in North America, despite the larger list in the literature. The species

inhabit the temperate or tropical zones, living on dead limbs of trees or shrubs.

For this study I have examined series of *carbonarius* and *rectangularis*, and the type species, *latus*.

<i>carbonarius</i> Hood (1908a:376) .....	Illinois
(?) <i>longiceps</i> Hood (1912d:153). New synonymy?	
<i>rectangularis</i> Hood (1908b:307) .....	Eastern U.S.A.
<i>salicis</i> (Watson), <i>Trichothrips</i> (1921b:80)	
<i>sordidatus</i> Hood (1927f:199) .....	California

### Diceratothrips Bagnall

Large, usually black, thrips similar in form to *Cryptothrips* except for the placement of the maxillary stylets. In *Cryptothrips* these stylets touch or nearly touch within the head; in *Diceratothrips* the stylets are placed far apart at the apex forming a V within the head. This genus is represented by more than a dozen species in North America.

For the moment *Diceratothrips* may be divided into at least three subgenera, *Diceratothrips* s. str., *Dichaetothrips*, and *Endacnothrips*. Quite likely, when more of the world species are available for restudy, such a division may not be appropriate.

#### Subgenus *Diceratothrips* s. str.

*Diceratothrips* Bagnall (1908:12). Type species by original designation: *Diceratothrips bicornis* Bagnall.

*Eulophothrips* Schmutz (1909a:278). Type species by monotypy: *Eulophothrips robustus* Schmutz. Synonymized by Priesner (1949).

*Megalomerothrips* Watson (1919a:99). Type species by original designation: *Megalomerothrips eupatorii* Watson. Synonymized by Priesner (1949).

*Head*. Elongate rectangular, fore margin of head not produced, dorsal surface weakly reticulate (Fig. 89); antenna eight-segmented, inserted just behind line drawn across fore margin of eyes, third segment elongate, usually more than twice as long as segment II; ventral surface of eyes sometimes slightly prolonged posteriorly; either the anteocellar or the postocellar setae longer than the other pair.

*Mouth parts*. Mouth cones bluntly pointed; broad maxillary stylets forming a V within the head.

*Thorax*. Major setae present although anterior pairs are smaller than those on the posterior margin; praepectus present; mesopraesternum well developed; metanotum hexagonally reticulate; fore tarsus of both sexes with a prominent tooth; fore femur of major males often with unusually developed inner spines; hind tibia with two long sensory hairs, one near the base and the other near the apex; fore wings broad with closely spaced fringe cilia and with many accessory cilia.

*Abdomen.* Pelta broad; tube slender to somewhat thick, fairly long, sometimes lightly ridged at base.

This *Cryptothrips*-like group was first described from the American tropics in the early days of thrips investigations of the New World. By now, about 18 species have been discovered. They occur mostly from Mexico southward, although a few are found in Florida and Texas, and one species ranges as far north as South Carolina. Apparently they live in colonies under bark and feed on fungus spores.

The typical subgenus differs from the other two subgenera mainly in the form of the head, judging by the published illustrations. The fore part of the head in *Dichaetothrips* is slightly prolonged so that the antennae are inserted in front of the eyes. In contrast, species of *Diceratothrips* s. str. have the antennae inserted ventrally on the head just behind an imaginary line drawn across the fore margin of the eyes. The subgenus *Endacnothrips* is separable by the heavy cheek spines.

*Diceratothrips eupatorii*, *D. delicatus*, and two unidentified species, both in series, one from Honduras and one from Mexico, were studied. The species from Honduras, which is almost identical with Schmutz's *robustus* and may well be that species, was represented by all stages from eggs to adults.

<i>cubensis</i> Hood (1941:178).....	Cuba
<i>delicatus</i> Hood (1941:171).....	Florida
<i>eupatorii</i> (Watson), <i>Megalomerothrips</i> (1919a:98).....	Florida
<i>harti</i> Hood (1912a:12).....	Texas
<i>inferorum</i> (Priesner), <i>Adiaphorothrips</i> (1933a:62).....	Mexico
<i>longipes</i> Hood (1912a:14).....	Texas
<i>obscuricornis</i> Hood (1941:174).....	Cuba
<i>pallidor</i> Priesner (1933c:151).....	Mexico
<i>picticornis</i> Hood (1914d:166).....	Panama, Cuba
<i>princeps</i> Hood (1934a:68).....	Panama, Mexico
<i>setigenis</i> Hood (1941:176).....	Texas
<i>wolcottii</i> Morgan (1925:8).....	Puerto Rico

#### Subgenus *Dichaetothrips* Hood

*Dichaetothrips* Hood (1914d:164). Type species by original designation:

*Dichaetothrips brevicollis* Hood.

*Diplacothrips* Hood (1937b:506). Type species by original designation:

*Diplacothrips borgmeieri* Hood. New synonymy.

This subgenus has the characteristics of the typical subgenus except that the mouth cones are more rounded, the head is slightly produced forward, and the anterior margin of the prothorax is slightly thickened. In insects as variable as the thrips, these characteristics might not be found to be constant if populations rather than solitary examples were examined.

Two species are reported to be in North America. *D. (Dich.) neivai*

Hood was described from Cuba; *D. (Dich.) williamsi* Karny has been found in Guatemala.

Most species of *Dichaetothrips* have well-developed postocellar setae. One species, the Hawaiian *brevicornis* Bagnall has both the anteocellar and postocellar setae reduced although the anteocellar pair are the most prominent. Another species, the Peruvian *borgmeieri* Hood, has long anteocellar setae whereas the postocellar setae are small.

It hardly seems worth while to place *borgmeieri* in a separate genus (as originally proposed) merely because of the length of the anteocellar setae. If that procedure were followed, then the near related *Cryptothrips* should be subdivided also. *Cryptothrips carbonarius* has long postocellar setae but most other North American *Cryptothrips* have short postocellar setae. As far as I know, thysanopterists are content to leave *carbonarius* in *Cryptothrips* and I think it is best, for the sake of consistency, to place *borgmeieri* in *Dichaetothrips*.

#### Subgenus *Endacnothrips* Priesner

*Endacnothrips* Priesner (1933c:149). Type species by monotypy: *Diceratothrips (Endacnothrips) horridus* Priesner.

This subgenus is much like *Diceratothrips* s. str. except that its representative is much more hairy and has each antennal segment III more elongated. In particular, the strong cheek setae are a good characteristic by which *Endacnothrips* can be easily distinguished from the other subgenera.

I have seen and studied the types of the sole species (Fig. 82), which were collected from Mexico.

#### *Elaphrothrips* Buffa

*Elaphrothrips* Buffa (1909b:162). Type species by subsequent designation of Moulton (1933b): *Thrips schotti* Heeger. Invalid; *schotti* not in original list of *Elaphrothrips*.

Type species by subsequent designation of Andre (April 27, 1940): *Idolothrips coniferarum* Pergande. Valid.

Type species by subsequent designation of Hood (October 18, 1940): *Idolothrips flavipes* Hood. Invalid; prior designation by Andre.

*Dicaiothrips* Buffa (1909b:169). Type species by subsequent designation of Bagnall (1910b): *Thrips schotti* Heeger. Synonymized by Hood (1927a).

Large black thrips with heads usually produced forward beyond the fairly large eyes, the front margin of the metasternum greatly shortened, and the maxillary stylets broad, forming a V within the head.

*Head.* Elongate, produced forward beyond eyes (Fig. 99); third antennal segment long; eyes moderate to large in size; some ocellar setae prominent; cheeks often with stout spines.



*Mouth parts.* Mouth cones broadly rounded; maxillary stylets broad, forming a V within the head.

*Thorax.* Pronotum with major setae developed although anterior pairs are smaller than posterior ones; praepectus present; praesternum well developed but proportionately small; anterior margin of mesosternum short (Fig. 30); fore legs occasionally enlarged, occasionally with a number of thick spines; fore wings broad, fringe cilia placed close together, metanotum hexagonally reticulate; hind legs often with basal as well as apical sensory hairs well developed.

*Abdomen.* Pelta broad, similar to Fig. 144; tube moderately long.

As pointed out by Bailey (1949) the type species of *Elaphrothrips* is *I. coniferarum* Perg. Other designations, *I. schotti* and *I. flavipes*, are invalid.

Because the differences between *Elaphrothrips* and *Idolothrips* are of a minor nature, it might be best to place *Elaphrothrips* as a subgenus of *Idolothrips*. They are said to differ in the proportionate lengths of the antennal segments and tube, and by the form of the lateral abdominal tubercles. I shall refrain from combining the two until I have a better knowledge of the species involved.

At first glance, several other large North American thrips resemble *Elaphrothrips*. Some *Actinothrips* might be confused with *Elaphrothrips*, but representatives of the former genus can be separated readily by the absence of praepectal plates and, as Hood pointed out in 1935, by the absence of a heavy masticatory apparatus in the fore gut. Another genus, *Anactinothrips*, resembles *Elaphrothrips* even more closely, but thrips of these genera may be distinguished from each other by the size of the mesopraesternum. In species of *Elaphrothrips* the mesopraesternum is narrow, whereas in species of *Anactinothrips* this structure is much wider.

Many species of *Elaphrothrips* are found in colonies with their young which are reported to be produced alive. My own observations of their life cycles have been limited to *E. tuberculatus*, a species that lays eggs which contain nearly fully developed embryos almost ready for hatching. Their chief food seems to be spores of fungus growing on dead standing leaves, grasses, or in hollow dead stems of herbs.

Six species occur in northeastern United States and Canada. More than a dozen species have been taken in Central America and the West Indies. None occurs on the west coast of temperate North America and none occurs in the colder zones. *Elaphrothrips* has been recorded from all of the tropical regions of the world.

- albospinosus Moulton (1929b:11).....Mexico
- angusticeps (Crawford, D. L.), *Idolothrips*
- (1910:168) . . . . .Cuba, Nicaragua, Mexico



<i>armatus</i> (Hood), <i>Idolothrips</i> (1908c:285) . . . . .	Eastern U.S.A.
<i>assimilis</i> (Bagnall), <i>Idolothrips</i> (1908:213) . . . . .	Central America
<i>aztecus</i> Hood (1941:208) . . . . .	Mexico
<i>bilineatus</i> Priesner (1933c:152) . . . . .	Mexico
<i>blatchleyi</i> Hood (1938c:410) . . . . .	Florida
<i>brevicornis</i> (Bagnall), <i>Dicaiothrips</i> (1910b:379) . . . . .	St. Vincent
<i>championi</i> (Bagnall), <i>Dicaiothrips</i> (1910b:375) . . . . .	Central America
<i>coniferarum</i> (Pergande), <i>Idolothrips</i> (1896:63) . . . . .	Eastern U.S.A.
<i>dampfii</i> Hood (1939:500) . . . . .	Mexico
<i>distinctus</i> (Bagnall), <i>Dicaiothrips</i> (1910b:378) . . . . .	Nicaragua
<i>flavipes</i> (Hood), <i>Idolothrips</i> (1908a:377) . . . . .	Eastern U.S.A.
<i>foveicollis</i> (Bagnall), <i>Idolothrips</i> (1908:214) . . . . .	Central America
<i>grandis</i> (Bagnall), <i>Dicaiothrips</i> (1910b:373) . . . . .	Central America
<i>longiceps</i> (Bagnall), <i>Idolothrips</i> (1908:211) . . . . .	Central America
<i>parallelus</i> Hood (1924a:315) . . . . .	Florida
<i>schultzei</i> Priesner (1933c:152) . . . . .	Mexico
<i>tener</i> Priesner (1925c:305) . . . . .	Mexico
<i>tuberculatus</i> (Hood), <i>Idolothrips</i> (1908c:287) . . . . .	Eastern U.S.A.
<i>vittipennis</i> Hood (1940a:579) . . . . .	Arizona

### **Goëtothrips Priesner**

*Goëtothrips* Priesner (1925c:316). Type species by original designation: *Goëtothrips terrestris* Priesner.

Degenerate, apterous members of the Megathripinae which are without ocelli and have a furrowed head process extending anteriorly between the antennae.

*Head.* As in Fig. 84, with a furrowed process extending forward of the anterior eye margin; cheeks hardly at all incut behind eyes; ocelli lacking; antennae eight-segmented, each segment freely movable.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets placed in V-shape within head.

*Thorax.* Completely apterous, without signs of wing pads; prothorax as in Fig. 84; fore tarsi of both sexes unarmed.

*Abdomen.* Pelta broad; tube (Fig. 36) short and with very short anal setae.

This genus is undoubtedly closely related to *Illinothrips*. Compared with *Illinothrips*, *Goëtothrips* may be recognized by the shorter head in which the cheeks are not incut behind the eyes and by the furrowed head process.

I have seen the types of the only known species, the Mexican *G. terrestris*.

### **Hybridothrips Stannard, new status**

*Actinothrips* subgenus *Hybridothrips* Stannard (1954c:74). Type species by original designation: *Actinothrips (Hybridothrips) oneillae* Stannard.

A genus near *Zeuglothrips* with many small sense cones only on the ventral side of the apexes of antennal segments III and IV.

*Head.* Formed much as in *Zeuglothrips*, prolonged in front beyond the eyes, transversely striate; postocellar, postocular and mid-dorsal setae long and thick; cheeks with three pairs of elongated setae, the anterior pair the smallest; antennal segment I with a short but differentiated setae which is thickened; antennal segments III and IV, apically and ventrally, with approximately 15 small sense cones; antennal segment VIII formed as in *Actinothrips* with the tip elongated.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets broad, placed in V-shape to far apart and parallel within the head.

*Thorax.* All major setae well developed, elongated and thickened; praepectus absent; mesopraesternum degenerate; fore tarsus of the male, at least, with a large tooth much as in *Zactinothrips elegans*; meso- and metanotum each with a pair of enlarged setae on the meson; wings with a long dark median streak, fore wing with approximately 20 accessory subapical fringe cilia.

*Abdomen.* Pelta broad; segment VIII of the male, at least, with a pair of lateral recurved toothlike projections; tube long, moderately hairy.

This genus combines characteristics of the genera *Zactinothrips* and *Zeuglothrips* in a striking manner. Its antennae, with the numerous small sense cones and the shape of the fore tarsal tooth, are similar to corresponding features in *Zactinothrips*. In the formation of the head, *Hybridothrips* bears close resemblance to *Zeuglothrips*.

Only the type species is known. It occurs in Central America: Mexico and Honduras.

### *Illinothrips* Stannard

*Illinothrips* Stannard (1954b:193). Type species by original designation: *Illinothrips rossi* Stannard.

Bulge-eyed thrips with broad maxillary stylets; from North America.

*Head.* Eyes, composed of about 10 dorsal facets, bulged from head much as in *Eurythrips* (Fig. 93). Antennae eight-segmented, segment VIII slender, not broadly attached to segment VII.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets broad, placed in V-shape within the head.

*Thorax.* Praepectus present but not large; mesopraesternum well developed; completely apterous; male with a spur before each mesothoracic spiracle (Fig. 19).

*Abdomen.* Tube short.

In appearance, *Illinothrips* is to the Megathripinae as *Eurythrips* is to

the Phlaeothripinae. Both of these genera have kegl-like eyes. They differ from each other principally in the thickness of the maxillary stylets, a distinction which also sets apart the aforementioned subfamilies.

In actual relationship, *Illinothrips* is closest to the African *Dexiothrips* and *Faureothrips*. All three of these genera are remarkably alike, differing principally in the shapes of the mesopraesternum and pelta and in having or not having praepectal plates. Here in North America *Illinothrips* is somewhat related to *Goëtothrips*, *Pseudocryptothrips*, and even to *Nesothrips*. A striking similarity is noticeable between *Illinothrips* males and some *Nesothrips* males, such as *N. acuticornis* and *N. ruficauda*. All of them may have identically formed spur-like processes in front of the mesothoracic spiracle. Neither *Goëtothrips*, *Pseudocryptothrips*, nor *Nesothrips* has bulged eyes, and by this characteristic, *Illinothrips* may be separated from them.

Only one species, *rossi*, is known. It is from sand areas in the mid-western part of our continent.

#### Megalothrips Uzel

*Megalothrips* Uzel (1895:224). Type species by subsequent designation of Priesner (1949): *Megalothrips bonannii* Uzel.

*Magalothrips* Hood (1927b:113). Misspelling for *Megalothrips*.

Large black thrips resembling *Megathrips* except that, among other features, it has a shorter prothorax and the anterolateral setae are placed closer to the anterior margin of the prothorax.

*Head*. Elongate, arched, relatively more slender than in *Megathrips*; area that bears antennae slightly produced beyond eye margin; interocular setae long; postocular setae sometimes long; antennae eight-segmented, each segment independently movable.

*Mouth parts*. Mouth cones broadly rounded; maxillary stylets broad, touching or nearly touching in center of head.

*Thorax*. Prothorax much shorter than in species of *Megathrips*; epimeral sutures incomplete; anterolateral setae not unusually displaced from anterior margin of prothorax—at least these setae are no farther away from the anterior margin than they are from the mid lateral setae; praepectus present; mesopraesternum well developed; fore wing broad, fringe cilia closely spaced, and with accessory fringe cilia.

*Abdomen*. Pelta large (Fig. 142); tube hairy; males with a pair of tubular processes on abdominal segment VI.

*Megalothrips*, by the characteristic of the normal placement of the anteromarginal prothoracic setae, is a more generalized genus than is its relative, *Megathrips*. On the other hand, *Megalothrips* is more special-

ized than *Megathrips* because the prothorax is shorter than it is in *Megathrips*.

Like *Cryptothrips*, *Megalothrips* is characterized by the arrangement of the maxillary stylets which touch within the center of the head. These two genera can be easily separated by the presence or absence of long setae on the tube. *Megalothrips* has a hairy tube whereas *Cryptothrips* does not.

The three North American species of this genus were keyed by J. C. Crawford in 1947.

*picticornis* Hood (1927f:204) . . . . . California, Utah, Oregon  
*animus* (Moulton), *Docessissophothrips* (1929c:242)  
*schuhi* Crawford, J. C. (1947a:197) . . . . . Oregon, Alaska  
*spinosus* Hood (1908b:306) . . . . . Eastern U.S.A.

### *Megathrips* Targioni-Tozzetti

*Megathrips* Targioni-Tozzetti (1881:120). Type species by monotypy: *Megathrips piccioli* Targioni-Tozzetti (= *Phloeothrips lativentris* Heeger).

Large black thrips with the anterolateral prothoracic setae placed close to the midlateral setae, with broad maxillary stylets placed in V-shape within the head, with hairy tube, and with praepectal plates.

*Head*. Shorter and proportionately wider than in *Megalothrips*; area that bears antennae slightly produced beyond eye margin; interocellar setae longer than either postocellar or postocular setae; antennae eight-segmented, each segment independently movable.

*Mouth parts*. Mouth cones broadly rounded; maxillary stylets broad, placed in V-shape within head.

*Thorax*. Prothorax much longer than in *Megalothrips*; epimeral sutures nearly complete to incomplete; anterolateral setae placed farther away from the anterior margin of the prothorax than these setae are from the mid lateral setae; praepectus present; mesopraesternum well developed; tarsi of both sexes unarmed.

*Abdomen*. Pelta large; tube fairly long and hairy; males with a pair of tubular processes on abdominal segment VI.

This genus together with *Megalothrips*, *Caudothrips*, *Bacillothrips*, and, according to authors, with *Siphonothrips* form a compact unit. Not only are all closely related to each other but also they are related to *Actinothrips* and its allies.

Of the *Megathrips* complex, only *Megathrips* and *Megalothrips* are found in North America. Species in the two genera can be separated by a number of characteristics among which are the differences in the lengths of the prothorax, the differences in the relative lengths and widths of the head, and the placement of the anterolateral prothoracic



setae. In my opinion these genera are so distinct that it is quite unnecessary to combine them as subgenera as Morison did in 1949.

There are two Nearctic species:

*hesperus* (Moulton), *Megalothrips* (1907:65).....California  
*lativentris* (Heeger), *Phloeothrips* [*sic*] (1852:479) ?Introduced from Europe  
to Ontario (INHS record)

### Nesothrips Kirkaldy

*Nesothrips* Kirkaldy (1907:163). Type species by monotypy: *Nesothrips oahuensis* Kirkaldy.

*Oedemothrips* Bagnall (1910a:680). Type species by original designation: *Oedemothrips laticeps* Bagnall. Synonymized by Bianchi (1944).

*Gastrothrips* Hood (1912d:156). Type species by original designation: *Gastrothrips ruficauda* Hood. New synonymy.

*Neosmerinthothrips* Schmutz (1913:1051). Type species by monotypy: *Neosmerinthothrips fructuum* Schmutz. New synonymy.

*Coenurothrips* Bagnall (1921:271). Type species by original designation: *Coenurothrips brevicollis* Bagnall. Made synonym of *Neosmerinthothrips* by Priesner (1949). New synonymy.

*Bolothrips* Priesner (1926a:90). Type species by original designation: *Phloeothrips* [*sic*] *bicolor* Heeger. New synonymy.

*Syncerothrips* Hood (1935b:191). Type species by original designation: *Syncerothrips harti* Hood. New synonymy.

*Bolothrips* subgenus *Botanothrips* Hood (1939:606). Type species by original designation: *Bolothrips* (*Botanothrips*) *pratensis* Hood. New synonymy.

*Probolothrips* Moulton (1941:319). Type species by original designation: *Probolothrips hambletoni* Moulton. Made synonym of *Gastrothrips* by Hood (1952b). New synonymy.

Small to medium-sized Tubulifera, with broad maxillary stylets placed in V-shape within a somewhat oval head, a short tube, and without strong reticulations.

*Head.* Usually more or less oval (Figs. 85-87); eyes small but composed of more than a dozen facets dorsally, often prolonged posteriorly on the ventral surface of the head; antennae eight-segmented although suture between segments VII and VIII may be weak, antennal segment III never longer than twice as long as segment II; cheeks rarely (except *anolis*) with large spines as in *Diceratothrips*.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets retracted far into the head, spaced far apart, the two stylets forming a V.

*Thorax.* Praepectus present; mesopraesternum usually well developed; fore wings somewhat broad, accessory fringe cilia present or absent.

*Abdomen.* Pelta broad, extended over most of segment I (Fig. 140); tube relatively short to medium-sized, occasionally thickened and even sometimes ridged.

As defined herein, *Nesothrips* includes a large assemblage of species



which, for the most part, have been known previously as *Gastrothrips* or *Bolothrips*.

The appearance of the species may vary from that of *Nesothrips bicolor* (formerly *Bolothrips bicolor*) with eyes greatly prolonged ventrally, to *Nesothrips ruficauda* (formerly *Gastrothrips ruficauda*) with eyes just barely prolonged on the ventral surface of the head. Head shapes range from those that are relatively long to those that are broad and short. Although the form of the pelta is usually the same in winged and wingless stages, in one undescribed species from Chiapas, at least, the brachypterous form may have a smaller pelta than the fully winged form. The pelta varies from a refined type to a broad type (Fig. 140). Elaborate structures may appear as in the males of *anolis* which may have finger-like prolongations of the posterior angles of the pronotum; in males of other species, such as *acuticornis* (Hood) and *ruficauda* (Hood), a toothed projection may occur at the sides of the body near the area of the mesothoracic spiracles.

Throughout the representatives of the genus the appearance of the antennae is more or less the same. No segments are exceptionally long, the apical segments are somewhat pedicellate although in one species, *harti*, segment VIII is broadly joined to segment VII, and the ventral protrusions of the apexes of the last few antennal segments are consistently present. This type of antenna is similar to *Cryptothrips*, to which *Nesothrips* is very closely allied.

Once, in 1935, Hood went so far as to suggest that *Gastrothrips* might "better be reduced to subgeneric rank" under *Cryptothrips*. As he later pointed out, *Cryptothrips* is distinctive in having closely spaced maxillary stylets and *Gastrothrips* in having these stylets placed in V-shape within the head. As long as this differentiating characteristic exists, I believe it would be more convenient to keep *Gastrothrips*, which herein is considered a synonym of *Nesothrips*, apart from *Cryptothrips*.

*Neosmerinthothrips* is also a name for members of this group, as is *Coenurothrips* which Priesner subordinated under *Neosmerinthothrips* in 1949. I have seen the type species of these two genera and in my judgment they are both closely related to that section of *Nesothrips* which contains those species that formerly were called *Gastrothrips*.

*Syncerothrips* was considered by Hood to be deserving of full generic rank, separate from *Gastrothrips*, because of the close union of antennal segments VII and VIII. By this characteristic, *Syncerothrips* would appear to be a synonym of *Neosmerinthothrips* since the type species of the latter genus, *Neos. fructuum*, has the same two antennal segments closely joined. In my opinion, both are synonyms of *Nesothrips* and are not separable by any known clear-cut characteristics.

In North America there are nearly two dozen species. Few occur in

the temperate regions; they become more numerous and diverse in the tropics. Collection data indicate that they live under bark, on dead limbs of trees and shrubs, or in grass clumps.

- abditus* (Hood), *Gastrothrips* (1935b:177)..... Panama  
*acuticornis* (Hood), *Cryptothrips* (1925b:65)..... St. Croix, Barbados  
*anolis* (Morgan), *Gastrothrips* (1925:7)..... Puerto Rico, Panama  
*proteus* (Hood), *Gastrothrips* (1933c:417)  
*bicolor* (Heeger), *Phloeothrips* [*sic*] (1852:477)...?Introduced from Europe  
to U.S.A.  
*andrei* (Watson), *Oedaleothrips* (1933c:49)  
*callipus* (Hood), *Gastrothrips* (1935b:182)..... Texas  
*capitalis* (Hood), *Gastrothrips* (1935b:174)..... Texas  
*collaris* (Bagnall), *Cryptothrips* (1917:26)..... St. Vincent  
*corvus* (Priesner), ?*Cryptothrips* (1933a:55)..... Mexico  
*dentipes* (Reuter), *Phloeothrips* [*sic*] (1880:12)...?Introduced from Europe  
to N.Y.  
*dominicanus* (Hood), *Gastrothrips* (1935b:170)... Dominica  
*fuscicauda* (Morgan), *Gastrothrips* (1925:6)..... Puerto Rico  
*gilvipes* (Hood), *Bolothrips* (1914d:169)..... Eastern U.S.A.  
*harti* (Hood), *Syncerthrips* (1935b:192)..... Texas  
*litoreus* (Hood), *Bolothrips* (1939:609)..... Texas  
*nigrisetis* (Hood), *Gastrothrips* (1935b:161)..... Panama  
*parvidens* (Hood), *Gastrothrips* (1935b:165)..... Panama  
*pratensis* (Hood), *Bolothrips* (*Botanothrips*)  
(1939:606)..... Texas  
*ruficauda* (Hood), *Gastrothrips* (1912d:156)..... Eastern U.S.A.  
*stygius* (Hood), *Gastrothrips* (1935b:186)..... Panama  
*texanus* (Hood), *Gastrothrips* (1912d:157)..... Texas  
*validipennis* (Hood), *Gastrothrips* (1938c:403)... Florida

## Oedaleothrips Hood

*Oedaleothrips* Hood (1916c:64). Type species by original designation: *Oedaleothrips hookeri* Hood.

*Myrmecothrips* Watson (1920b:20). Type species by original designation: *Myrmecothrips querci* Watson. Synonymized by Watson (1923).

*Myrmecothrips* Priesner (1926b:485). Type species by original designation: *Myrmecothrips dampfi* Priesner. Preoccupied by *Myrmecothrips* Watson, synonymized by Hood (1936c).

*Formicothrips* Priesner (1928a:479). New name for *Myrmecothrips* Priesner.

Antlike Tubulifera with swollen head and narrowed pterothorax.

*Head.* Elongate, usually greatly swollen behind eyes (Fig. 91); eyes often prolonged posteriorly on the ventral surface of the head; antennal segment III elongate.

*Mouth parts.* Mouth cone broadly rounded; broad maxillary stylets retracted far into the head, usually spaced far apart within the head.

*Thorax.* Prothorax small; pterothorax small and narrow; metanotum often with concentric striae; praepectus present; mesopraesternum well developed but narrow; all American species wingless.

*Abdomen.* Pelta broad, much like that found in *Nesothrips bicolor*; lateral paired white spots on one to several segments.

Stemming from the *Nesothrips* group and arising near the branch that gave rise to *Pseudocryptothrips*, *Oedaleothrips* has evolved at a tangent, becoming degenerate in some respects and most elaborate in other respects. *Compsothrips* probably stands as an intermediate between *Oedaleothrips* and *Nesothrips*. Quite possibly *Oedaleothrips* is only a subgroup of *Compsothrips*.

Faure's *Hartwigia*, proposed in 1949, may prove to be the winged form of *Oedaleothrips*. Hartwig (1952) with good reasons subordinated *Oedaleothrips* under *Leptogastrothrips* Trybom. I have not followed Hartwig herein because I have not yet seen the critical specimens which would permit me to formulate my own opinions.

The most distinctive single feature of these thrips is the form of the pterothorax. In all species of *Oedaleothrips* the pterothorax is reduced and is clearly much narrower than the pronotum. The degree of narrowness of the pterothorax varies interspecifically; many are very narrow, but one species from Chiapas, Mexico, is only moderately narrow in this region. Another distinctive characteristic is the swollen head, but again, as in the case of the pterothorax, there is considerable variation. Some species have very swollen heads, other species have heads which are much less swollen.

In North America there are more than a dozen species, a few of which are found in the temperate zones as far north as Nebraska, Colorado, Illinois, and Iowa (INHS records). I have studied long series of *jacksoni*, *campestris*, *graminus*, and three undescribed species from New Mexico, Chiapas, and Yucatan.

<i>baileyi</i> Hood (1941:193).....	Kansas
<i>bradleyi</i> Hood (1937a:111).....	Florida
<i>brunneus</i> Hood (1941:187).....	Florida
<i>campestris</i> Hood (1941:190).....	Southeastern U.S.A.
<i>dampfi</i> (Priesner), <i>Myrmecothrips</i> (1926b:488).....	Mexico
<i>graminis</i> Hood (1936c:265).....	St. Croix
<i>hookeri</i> Hood (1916c:64).....	Texas
<i>hubbelli</i> Watson (1931c:341).....	Oklahoma
<i>jacksoni</i> Hood (1925c:137).....	Colorado, Texas
<i>querci</i> (Watson), <i>Myrmecothrips</i> (1920b:20).....	Florida
<i>yosemitae</i> (Moulton), <i>Formicothrips</i> (1929a:135).....	California

### Parallothrips Hood

*Parallothrips* Hood (1939:602). Type species by original designation: *Parallothrips thomasi* Hood.

Degenerate tubuliferans with broad maxillary stylets, with antennae seven-segmented, with all tarsi one-segmented, with divided meso-

thoracic sternum, and with the last two antennal segments closely joined.

*Head.* Smooth; eyes degenerate with 9 to 11 facets, only two of which are ventral; antennae seven-segmented, last two segments closely joined; third antennal segment small, smaller than II, about same size as IV.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets broad, retracted far into the head, touching in the middle of the head.

*Thorax.* Completely apterous without even vestiges of wing pads; praepectus absent; mesothoracic sternum divided in two (Fig. 26); all legs with one-segmented tarsi; fore tarsus of male with stout tooth, female unarmed.

*Abdomen.* Pelta much as in *Allothrips* but becoming degenerate; tube short.

Although closely related to and derived from *Allothrips*, *Parallothrips* deserves to be considered a full genus because of its unique characteristics. While not mentioned in any of the previous descriptions of these thrips, *Parallothrips* does possess several morphological traits not usually met with in the Tubulifera. Unlike *Allothrips* as well as most other genera of Tubulifera, *Parallothrips* has all tarsi one-segmented and the mesosternum of the thorax is deeply incut along the meson dividing this sternal plate in two. *Parallothrips* also differs from *Allothrips* by the close union of the last two antennal segments. In *Allothrips* a short pedicel separates these two antennal segments.

My former supposition (1955b) that *Parallothrips* and *Allothrips* might be considered as one genus was based entirely on information derived from the literature. Now before me are paratypes of *Parallothrips mavromoustakisi* Crawford, J. C. Obviously these thrips are degenerate *Allothrips* with fused tarsi and reduced sternal sclerites, considerably diverged from the ancestral *Allothrips* type and worthy of generic rank. Presumably the type species *thomasi* has fused tarsi also, despite the lack of mention in the original description of such an easily observed characteristic.

Two species are known—*thomasi* from Texas and *mavromoustakisi* from the Mediterranean island of Cyprus. My concept of the genus is based on the latter species, the only species available to me.

#### Priesneriella Hood

*Priesneriella* Hood (1927f:198). Type species by original designation: *Priesneriella citricauda* Hood.

Small apterous Tubulifera with broad maxillary stylets and with antennae only six-segmented.

*Head.* Smooth (Fig. 96); eyes degenerate with about 10 facets, only two or three of which are ventral; antenna six-segmented, segment III



small, segment II with dorsal sensorium placed approximately in the middle.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets broad, retracted far into the head, placed far apart from each other.

*Thorax.* Completely apterous; praepectus apparently absent; mesothoracic sternum divided nearly in two as in Fig. 26; mid and hind tarsi each two-segmented.

*Abdomen.* Pelta consisting of a square middle piece which posteriorly expands laterally into a broad transverse band; tube short.

This genus is obviously derived from *Allothrips*. It is more degenerate than *Allothrips*, in that *Priesneriella* has the last three (instead of two) antennal segments fused and the mesosternal sclerite has become divided into tiny platelets along the meson.

Although *Priesneriella* became specialized by degeneracy in the fusion of the terminal antennal segments, it did not specialize in the direction of the fusion of the mid and hind tarsal segments as did its close relative, *Parallothrips*.

Originally Hood related *Priesneriella* to *Allothrips*, a conclusion with which I agree. However, it is not at all related to *Trichothrips*, *Lissothrips*, or *Williamsiella*, as Hood further contended. The latter genera belong to the Phlaeothripinae and have slender maxillary stylets; *Priesneriella* belongs to the Megathripinae, together with *Allothrips* and *Parallothrips*, and these genera have broad maxillary stylets.

I have studied a female paratype of *citricauda* from Palo Alto, California, kindly lent to me by the Academy of Natural Sciences in Philadelphia. This is the only species so far assigned to the genus.

#### **Pseudocryptothrips Priesner**

*Pseudocryptothrips* Priesner (1919a:12). Type species by monotypy: *Pseudocryptothrips meridionalis* Priesner.

Tubulifera resembling *Allothrips* except that the antennae are each eight-segmented.

*Head.* Elongate, cheeks somewhat incut just behind eyes (Fig. 94); eyes small, usually composed of but a few large facets; antenna eight-segmented, inserted forward of the anterior eye margin; postocular setae well developed.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets retracted far into the head, spaced fairly far apart.

*Thorax.* Epimeral sutures usually incomplete; praepectus present; mesopraesternum degenerate (Fig. 27); usually brachypterous.

*Abdomen.* Pelta broad; tube short and stout.



The principal distinctive difference between *Pseudocryptothrips* and the closely related *Nesothrips* is in the form of the eyes. Often the eyes of species in *Pseudocryptothrips* are reduced to only a few large facets. There are indications of a depression of the head behind the eyes but this incut area is not as pronounced as in representatives of *Illinothrips*. Rarely specimens are found that bear a small spur on the cheeks at the base of the eyes. On almost all other points *Pseudocryptothrips* is similar to various species assigned to *Nesothrips* except that males apparently do not have fore tarsal teeth as do males of *Nesothrips*. Such teeth are absent in females of both genera. From *Allothrips*, *Pseudocryptothrips* differs in the number of antennal segments.

These degenerate thrips are known from southern Europe, South Africa, Hawaii, southern portions of the United States of America, Mexico, certain islands of the West Indies, and Trinidad. The sole North American species, *gradatus* (Hood), was described in 1925 in the genus *Cryptothrips*.

### Pygidiothrips Hood

*Pygidiothrips* Hood (1938c:389). Type species by original designation: *Pygidiothrips seminole* Hood.

Small, degenerate Tubulifera with each antenna six-segmented, and with a short thick tube superficially as in *Pygothrips*.

I do not know this genus. Since Hood related it to *Priesneriella* I have assumed that it belongs in and has the characteristics of the subfamily Megathripinae as does *Priesneriella*.

Only the type species is known. Originally three females were taken from a dead branch at Homestead, Florida. No other records have been published since, if, indeed, the species has ever been found again.

### Pygothrips Hood

*Pygothrips* Hood (1915b:49). Type species by original designation: *Pygothrips rugicauda* Hood.

Tubulifera with enormously swollen tubes.

*Head*. Smooth; eyes not usually, but occasionally, elongated posteriorly on the ventral surface; antennae inserted on the ventral surface of the head, segments VII and VIII either very closely joined or partially fused; ocellar setae sometimes well developed.

*Mouth parts*. Mouth cones broadly rounded; broad maxillary stylets retracted far into the head, positioned either far apart, forming a V, or touching within the center of the head.

*Thorax*. Epimeral sutures often incomplete, not reaching the posterior margins of the pronotum; praepectus present but sometimes small; mesopraesternum degenerate.

*Abdomen.* Pelta large, sometimes reduced to a wide transverse band; tube enormously swollen; anal setae short.

Despite the novel form of its tube, this genus does not deserve to be placed in a separate family as originally proposed. Step by step intergrades in the form of the tube from the normal type to the *Pygothrips* type are now known. Such exotic genera as *Acallurothrips*, *Pharetrothrips*, and *Diplochelaethrips* can be selected to demonstrate the transition of the form of the tube from one extreme to the other.

Actually *Pygothrips* is but a specialized genus derived from the *Nesothrips* stem. Often the head shape and eye prolongations are identical to species in *Nesothrips*. Although the enlarged tube is an additive specialization, the reduction of the praepectal plates and the reduction of the mesopraesternum are specializations by degeneration. All of the specialized tendencies shown in *Pygothrips* are to a lesser degree evident in *Nesothrips*. There are even cases in *Nesothrips* in which the tube becomes slightly enlarged.

Five species are known from North America. They occur from Florida to Panama. For this work I have studied specimens from Florida and Yucatan.

<i>albiceps</i> Hood (1938c:40).....	Florida
<i>breviceps</i> Hood (1933c:419).....	Panama
<i>fortis</i> Hood (1938c:402).....	Florida
<i>needhami</i> Hood (1938c:397).....	Florida
<i>zeteki</i> Hood (1933c:420).....	Panama

#### *Rhaphothrips* Crawford, D. L.

*Rhaphothrips* Crawford, D. L. (1909b:116). Type species by monotypy: *Rhaphothrips peculiaris* Crawford, D. L.

A temporarily unusable genus based upon a larva.

D. L. Crawford described this genus on the basis of a Mexican larval thrips, all the while believing he had an adult specimen before him. Although his misidentification of the life stage of this thrips was corrected years ago, it has been impossible to use the genus because of our lack of knowledge of larval characteristics of the other genera. At present we have no way to compare or relate this genus with the rest of the genera in the Tubulifera which are based almost exclusively on adult characteristics. Even so, contrary to the opinions of some authors, *Rhaphothrips* is a valid genus according to the International Rules of Nomenclature, Article 27.

I have seen the unique type, *peculiaris*, the only species in the genus, which is deposited in the Canadian Museum. It is a member of the Megathripinae and appears to belong near *Elaphrothrips*, *Diceratothrips*, or some other related genus.

### Sporothrips Hood

*Sporothrips* Hood (1938c:410). Type species by original designation: *Adiaphorothrips amplus* Hood.

Long-headed members of the Megathripinae with antennal segment III more than twice as long as segment II, and with the pelta formed and sculptured as in *Nesothrips bicolor* (Fig. 140).

*Head.* Elongate (Fig. 92); posterior portion of cheeks swollen; antennal sockets produced forward; antennal segment III long, more than twice as long as segment II.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets retracted far into the head, positioned far apart.

*Thorax.* Praepectus present; mesopraesternum well developed (Fig. 28), not narrowed as in *Elaphrothrips*; notal reticulations faint in brachypterous specimens.

*Abdomen.* Pelta broad (Fig. 141), sculptured much as in *Nesothrips bicolor*; tube moderately long.

This genus is most difficult to define. When limited to comparisons with only North American thrips, *Sporothrips* can be recognized easily by a combination of characteristics. If, on the other hand, certain Australian groups are considered, *Sporothrips* seems less distinctive.

The Floridian *amplus* is the only known species.

### Zeuglothrips Hood

*Zeuglothrips* Hood (1936d:452). Type species by original designation: *Zeuglothrips echinus* Hood.

Members of the Megathripinae near *Actinothrips* which bear three pairs of enlarged dorsal head setae and two pairs of enlarged cheek setae.

*Head.* Elongate, transversely striate to intermediate between hexagonally reticulate and transversely striate; postocellar, postocular and mid dorsal setae long and thick; cheeks with two pairs of enlarged, conspicuous setae; antennal segments III and IV elongate without numerous minute sense cones at the apices.

*Mouth parts.* Mouth cones broadly rounded; maxillary palps large.

*Thorax.* Most of the major prothoracic setae well developed and thickened, anteromarginal pair sometimes smaller than the rest; praepectus absent; mesopraesternum degenerate; fore tarsus of male with small tooth, female unarmed.

*Abdomen.* Pelta broad; tube long, hairy and ridged in one species, less hairy, nearly bare in another species.

My concept of this genus is based upon Hood's original description and one male specimen of an undescribed species taken in Panama which is now deposited in the collections of the United States National Museum. Apparently, if the two species, *echinus* based on a single female from Peru and the new species from Panama as represented by a single male specimen, are congeneric, the vestiture of the tube varies considerably. It may be that only males have hairy tubes.

### **Zeugmatothrips Priesner**

*Zeugmatothrips* Priesner (1925c:313). Type species by original designation: *Zeugmatothrips hispidus* Priesner.

Members of the Megathripinae near *Actinothrips* which usually lack enlarged cheek setae, or have only one pair just behind the eyes.

*Head.* Moderately elongate, surface not tuberculate, finely hexagonally reticulate to transversely striate; eye region somewhat bulged from head; antennal sockets slightly prolonged forward; intermediate antennal segments elongate; antennal segment I with an exceptionally long setae; postocular and usually mid dorsal setae long and thickened.

*Mouth parts.* Mouth cones broadly rounded; broad maxillary stylets placed fairly far apart and parallel within the head.

*Thorax.* All major pronotal setae long; praepectus absent; mesopraepectus degenerate; many leg setae extremely long and prominent; fore wings narrow with a dark median streak; fringe cilia not closely spaced. Metanotum with a pair of heavy spines located medially.

*Abdomen.* Pelta broad; tube long and hairy.

To date three species are known to occur in tropical North America. The remainder of the described species are from South America. Most of them are fully winged, but I have seen a specimen from Trinidad which is brachypterous.

<i>hispidus</i> Priesner (1925c:314).....	Mexico
<i>hoodi</i> Priesner (1927:189).....	Central America
<i>priesneri</i> Hood (1935a:102).....	Panama



## Phylogeny

Today the family Phlaeothripidae is the most diversified group of thrips. Not only does it include more species than does any other family of Thysanoptera, but often its species have several forms distinctive in appearance. Besides numerical superiority, the Phlaeothripidae contains the majority of the extreme thrips types. It has one of the smallest thrips and certainly the largest. No species of Terebrantia is as spectacularly adorned as are several species of Phlaeothripidae, yet on the other hand, the most faintly marked, degenerate thrips also belongs to this family. Species that stridulate and species that give birth to active larvae occur in the Phlaeothripidae. Transitional species of Phlaeothripidae that bridge generic groups are common. In short, this family has as its constituents a wide variety of types and extremes all well bound together by intermediate links.

One reasonable conclusion suggested by the existence of such an array of closely connected genera is that the main body of the Phlaeothripidae is of relatively recent origin. The family has evolved so recently that many precursors and intermediates have not been eliminated as yet by the catastrophies and hazards of changing environments which eventually occur over long periods of time.

That the rise of the Phlaeothripidae is relatively recent and, incidentally, highly successful, is based on much other circumstantial evidence than their present diversity and the existence of links. Their general structure is seemingly derived from and not basic to features exhibited by the Terebrantia. Furthermore, specimens of Phlaeothripidae are rare in fossil beds, at least they are not found until the Oligocene and even then they have not been preserved so frequently as have the Terebrantia. This last point suggests the possibility that the Phlaeothripidae did not become a major group until late Tertiary times.

It is principally by the specialization of their features that the Phlaeothripidae can be presumed to be more recently evolved than certain elements of the Terebrantia. A study of the comparative morphology of all thrips (living and fossil) based on a knowledge of the characterizations of other related insect orders best demonstrates that the Phlaeothripidae have reached a high position in the evolutionary scale.

Thrips, both the Terebrantia and the Tubulifera, are closely related in all respects to the Homoptera, especially the aphid branch, the



sternorhynchous Homoptera. The Homoptera and the Thysanoptera, the advanced Hemiptera, the more primitive Anoplura, Mallophaga, and Corrodentia form a distinct phyletic line of insects. That the Corrodentia-Hemiptera line is a distinct unit and that the thrips are a part of it, while worthy of further elaboration, is not the subject under consideration here. Rather, for the time being, the placement of the Thysanoptera after the Corrodentia and before the Homoptera-Hemiptera is accepted according to the reasons advanced by Jordan (1888), LaMeere (1935), and others.

Certainly the Corrodentia represent a group that is primitive to and related to the Thysanoptera. Primitive Corrodentia probably had four- or five-segmented maxillary palps, two-segmented labial palps, antennae many segmented, five-segmented tarsi, fairly broad wings with reduced venation, and movable gonopods. Each chisel in the psocids is a modified maxillary lacinia which in the thrips and in the true bugs has become further specialized into a long stylet.

Those thrips which most closely resemble the primitive Corrodentia belong to the Terebrantia, particularly species in the family Aeolothripidae. In the Aeolothripidae the wings are fairly broad with several veins, the maxillary palps are basically three-segmented (Stannard 1952a), the labial palps two-segmented, the antennae nine-segmented, the gonopods are movable in both sexes, and the tarsi are two-segmented. No other group of thrips can be placed so close to the Corrodentia. Even the fossil record indicates that the Aeolothripidae are the oldest of the Thysanoptera.

Presumably the Heterothripidae developed from some primitive stock of Aeolothripidae. Except for a change in the contour of the female ovipositor and narrowed wings, the Heterothripidae changed little from its prototype. Still today there exist genera, *Fauriella* and *Opistothrips*, that are intermediate between the Aeolothripidae and the Heterothripidae.

From within the Heterothripidae several lines appear to have developed and the Terebrantia then greatly increased in diversity. Possibly both the Merothripidae and the Thripidae arose from a generalized Heterothripidae. Some species of Merothripidae still have nine segments in the antenna as well as other features similar to the Heterothripidae, including the circular type of antennal sensoria on segments III and IV. Most notably, representatives of Merothripidae have reduced ovipositors. Females of the family Uzelothripidae, newly erected by Hood (1952b), also have weakly developed ovipositors. In the Thripidae a reduction of the antenna from nine segments to eight or less occurred and a further narrowing of the wings and loss of veins continued.

At some time during this course of evolution, the Phlaeothripidae

emerged from the Terebrantia. Most likely they arose from species of Terebrantia that were related to the tribe Heliothripini of the Thripidae. No group of Terebrantia has as many similarities with the Phlaeothripidae as do the Heliothripini. It is primarily in the Heliothripini that some genera have each tarsus reduced from two to one segment, as for example, *Brachyurothrips*, *Hercothrips*, *Heliothrips*, and *Selenothrips*; that some genera have the maxillary palps reduced from three to two segments, such as *Dinurothrips* and *Heliothrips*; and that some genera have the mesospinasternum completely fused to the metasternum; e.g., *Selenothrips* and *Dinurothrips*. In the Heliothripini, pleural plates are frequently absent from the abdomen, and often the sense cones of antennal segments III and IV are linear as is always the case in the Phlaeothripidae. Furthermore, in the genus *Heliothrips* the wing fringe cilia are nearly straight, as in all Phlaeothripidae.

Some modern Heliothripini are outstanding because of the development of the last abdominal segment into a tube. Such genera as *Tryphactothrips*, *Panchaetothrips*, and *Dinurothrips* have exceptionally long tubes, although the sawlike ovipositor is still present. Some other nonheliothripoid genera (e.g., *Oxythrips* and *Macrurothrips*), also have tubes, but these genera are specialized in other respects in the direction of the higher Thripidae and not toward the Phlaeothripidae. The fossil *Stenurothrips*, a possible derivative of the Aeolothripidae, had an exceptionally long tube surrounding the ovipositor, but it is on another phyletic line that presumably was an evolutionary dead end.

If the Phlaeothripidae actually did originate from a *Heliothrips*-like ancestor, then that ancestor in its early stage could have had a well-developed tube. The Phlaeothripidae did not necessarily lose the saw in the manner of the Merothripidae and then develop a tube. Rather, on the basis of *Panchaetothrips*, it may be supposed that the tube developed before any reduction in the saw occurred.

In their final development the Phlaeothripidae produced a number of highly specialized genera which are now entirely distinct from the Heliothripini. Especially distinctive phyletic lines or groups of the Phlaeothripidae also evolved. These lines and groups are designated herein as the *Neurothrips*, *Docessissophothrips*, *Amphibolothrips*, *Gigantothrips*, *Haplothrips*, *Glyptothrips*, *Williamsiella*, *Plectrothrips*, *Hydiotrips*, and *Idolothrips* lines. Except for the *Idolothrips* line, the aforementioned lines are divisions of the subfamily Phlaeothripinae. The *Idolothrips* line includes all of the genera in the Megathripinae. In their greatest development each one of these lines is represented by species whose features are elaborately modified from the primitive *Heliothrips*-like structures. An analysis of the specialized and less specialized members of each line shows convincingly that these elaborate structures are

directly traceable to more generalized types similar to the *Heliothripini*.

There follows an analysis of the aforementioned lines. Characteristics of the specialized forms are compared with more generalized species in each of the phyletic lines. These groups are then compared with each other and a composite ancestor is proposed. Finally, a summary is presented to show the possible trends and directions of the evolution of the Phlaeothripidae from the supposed ancestor to the various end points.

### Idolothrips Line

This group includes all those genera assigned to the Megathripinae.

#### RETROGRADATION

In North America some species of the genus *Elaphrothrips* (a close relative of the Australian *Idolothrips*) are spectacularly developed. Unlike the more or less round-headed representatives of the *Heliothripini*, *Elaphrothrips* has an elongated head which is often extended forward beyond the eyes (Fig. 99). Furthermore this genus is specialized because of the frequent enlargement of the ocellar setae, the elongation of the intermediate antennal segments, the narrowed mesopraesternum, the closely spaced wing fringe cilia, and the fairly long tube.

Such specializations never reach this high degree of development in the more conservative members of the line. For example, in *Diceratothrips* the head is rarely produced forward beyond the region of the eyes (Fig. 89), and the length of the intermediate antennal segments is relatively less than in *Elaphrothrips*. Principally *Diceratothrips* lacks elaborate body projections and the mesopraesternum is not narrowed. Nevertheless, *Diceratothrips* is an advanced thrips, of large size, with an elongated head, with heavy reticulations, and with long ocellar setae, as in *Elaphrothrips*.

In *Cryptothrips*, which is closely allied to *Diceratothrips*, the ocellar setae are often smaller, and sometimes the intermediate antennal segments are shorter than in *Diceratothrips*. Otherwise *Cryptothrips* takes its place as one of the somewhat specialized members of the *Idolothrips* line.

Genera of this line with a shorter head and shorter intermediate antennal segments are definitely more *Heliothrips*-like and therefore more primitive. Some of these more generalized species belong to *Nesothrips*.

At the level of *Nesothrips* certain changes are particularly noticeable. First, the intermediate antennal segments are much shortened; second, the tube is shorter (in some offshoots of *Elaphrothrips* the tube is very

long); and third, the head is short and oval (Fig. 85). Still much as in *Elaphrothrips*, the maxillary stylets are broad, the praepectus and mesopraesternum are well developed, and the pelta is still somewhat broad (Fig. 140).

In this line there are considerable numbers of side branches. The various deviations found in members of these side branches can be traced back to thrips in *Elaphrothrips*, *Cryptothrips*, or to *Nesothrips*. Briefly, these side branches are:

The *Compsothrips* spur: Although the thorax is considerably narrowed, the principal structures found in this group are also found in a modified way in many of those species of *Nesothrips* that could be called the *bicolor* complex. Species of *Oedaleothrips* (Fig. 91), an American type of the African *Compsothrips*, often have the eyes prolonged ventrally much in the manner of *Nesothrips bicolor* (Fig. 86). In almost all other respects, the *Compsothrips* spur can be related to complexes of *Nesothrips*.

The *Allothrips-Pseudocryptothrips* spur: This side branch contains a number of degenerate entities. Their specialized characteristics can be related back to *Nesothrips* or *Cryptothrips*. In the past some authors placed *Allothrips* and similar genera such as *Parallothrips* and *Priesneriella* near *Phlaeothrips*, or *Hoplothrips* as it was called then. Such placement is artificial and not even within the confines of one subfamily. *Illinothrips* also is a member of this spur.

The *Pygothrips* spur: These thrips are essentially like *Nesothrips*, particularly like the group that was formerly called *Gastrothrips*, except that the tube is greatly swollen.

The *Actinothrips* spur: Generally members of this spur have long tubes and elaborately developed setae. They lack praepectal plates. All may have developed at a slight tangent from the *Pseudocryptothrips* ancestor. Included would be *Atractothrips*, *Dermothrips*, and others.

Miscellaneous spurs: In other regions of the world, particularly in Australia, the Philippines, or in southern Asia, spurs have developed which embrace genera characterized by having appendages on the thorax, elongated heads, numerous spines in the fore femora, etc. Most of their specializations are minor to the fundamental form which is *Idolothrips*-like.

#### REDINTEGRATION

A prototype of the *Idolothrips* line may be drawn from the knowledge of the tendencies and the common structures noted in the review of this line. Such a prototype may be considered to have the following characteristics:



*Head.* Not prolonged before the eyes, generally oval, antenna without excessively elongated segments, with broad maxillary stylets which retract at least a moderate distance into the head, and without long ocellar setae.

*Thorax.* With hexagonal reticulations; praepectus well developed (Fig. 23); mesopraesternum well developed but not narrowed (Fig. 28); wings moderately broad, fringe cilia placed fairly close together.

*Abdomen.* With a broad type of pelta; tube small in size, possibly with reticulations or ridges.

The chief gap between the primitive species of the Megathripinae and those of the Phlaeothripinae occurs in the size of the maxillary stylets. In the former the stylets are broad, whereas in the latter groups these stylets are slender. Although this difference is distinctive, it is not a difference of great magnitude and there is every reason to suppose that the *Idolothrips* ancestors came from the same primitive groups as did the other lines of the Phlaeothripinae.

From the prototype as proposed here, the *Nesothrips* group probably developed and became most diversified. Some of its species produced the swollen-tubed *Pygothrips*. Some of its species regressed into degenerate types that eventually produced, on one hand, the small-eyed *Allothrips* (Fig. 95) and, on the other hand, the antlike *Oedaleothrips*, and in a different direction, *Actinothrips* or *Atractothrips*. Another *Nesothrips*-like group developed into thrips with longer heads which in time became *Cryptothrips*-like (Fig. 88). From these long-headed thrips the *Elaphrothrips-Idolothrips* branch was produced.

As the *Elaphrothrips* group evolved, the head elongated still further (see Hood 1936d, Fig. 2), body appendages often appeared, the front margin of the metasternum narrowed, stridulating surfaces on the fore coxae became raised, a tendency to produce living young superseded the egg-laying characteristic, and total body size greatly increased.

This line flowered mostly in the tropics. A few have managed to prosper in the temperate regions but very few extended into the Taiga zone. The most spectacular species are strictly tropical in distribution and their representatives are found in all of the warm areas of the world.

### Neurothrips Line

Genera assigned to this line are believed to be of common descent because all of them lack praepectal plates, most of them have long pointed mouth cones (Fig. 7), they have strong tendencies to develop conspicuous warts on the cheeks (Fig. 18), and many of the higher forms have vase-shaped intermediate antennal segments. The generalized members of this line grade into those in *Phlaeothrips*.



## RETROGRADATION

The genus *Neurothrips* is an outstanding example of a spectacularly specialized form. Most likely it is of recent origin. Certainly it is far removed from its terebrantian ancestor.

The following characteristics of *Neurothrips* are considered to be specialized:

*Head.* Eyes generally large, bean-shaped (Figs. 76, 78); setal sockets, especially on the cheeks, enlarged, wartlike; intermediate antennal segments vasiform.

*Thorax.* Fore femora, in both sexes, with strongly developed spurs; fore wings bowed outwardly, seemingly twisted.

*Abdomen.* Pelta small, reticulated only in the middle (Fig. 135); wing-retaining setae expanded, leaflike; anal setae unusually long.

Undoubtedly the condition of wartlike setal sockets on the cheeks is a highly specialized condition. It is only in species which are advanced in other respects that these sockets may become enlarged as in *Neurothrips*, *Acanthothrips*, and several other related genera. *Neurothrips* exhibits the extreme condition by having these sockets so enlarged that their height is nearly as great as the length of the setae which arise from them.

Vasiform antennal segments are uncommon in the Thysanoptera. Usually the segments are globular or more or less cylindrical. Although the vasiform type of antennal segment might be considered peculiar, it does occur elsewhere than in the *Neurothrips* line. For instance, even some species of the Heliothripini have similarly shaped antennal segments. Most likely this specialization has come about by parallel development on several occasions.

Other characteristics of *Neurothrips* that deserve special note are the flat, leaflike, wing-retaining setae and the twisted wings. Few genera have wing-retaining setae so flattened. Nevertheless, this condition does recur in some members of the Glyptothripini and is undoubtedly another case of parallelism. A twisted wing is not likely a primitive characteristic. Some species of *Idiothrips* also bear twisted wings and because this latter genus is probably a form derived from the ancestor that produced *Amphibolothrips*, it might be assumed that both the *Neurothrips* and the *Amphibolothrips* line are somewhat related. The twisted wing condition may have developed in parallel in each line from a tendency that was first initiated in their common ancestor.

In most respects *Neurothrips* is similar to several genera near *Phlaeothrips*. All species of these groups have slender maxillary stylets, lack praepectal plates, have a long pointed mouth cone, a reduced pelta, and are heavily reticulate.

Genera such as *Eupathithrips*, *Sedulothrips*, and *Acanthothrips* are similar to *Neurothrips* not only in the basic characteristics but also in certain specializations. Many species of most of these groups have vasi-form antennal segments and enlarged cheek warts or setal sockets. Some of them even have peltae remarkably like the type found in *Neurothrips* (Figs. 132, 133). Because of their own minor peculiar specialties, *Sedulothrips* and *Eupathithrips* seem to be side branch deviations. Most likely, species of *Acanthothrips* are representative of the more primitive part of the main line; certainly they are more simply formed than are species of *Neurothrips*.

The eyes of *Neurothrips* are positioned fairly close together (Fig. 76). In species of *Acanthothrips*, especially in *albivittatus*, the eyes tend to be farther apart. However, in the Mexican species *Acanthothrips itzanus* (Fig. 75) the eyes are closer together than in *Neurothrips*. Another characteristic, the pelta, may be traced backward from *Neurothrips* to *Acanthothrips*. A gradual change can be noted from the *Neurothrips* type (Fig. 135), to *Acanthothrips albivittatus* (Fig. 133), to *Acanthothrips nodicornis*, and finally to *Acanthothrips coriaceus* (Fig. 132). This change is from the specialized pelta with only the central portion reticulate to the more primitive pelta which is uniformly marked.

An arrangement of the adults of *Acanthothrips* can be made to show a gradual progression from those nearly like *Neurothrips* to those that are more similar to species of *Hoplandrothrips*. Actually these changes from *Acanthothrips* to *Hoplandrothrips* are so gradual that the two are somewhat difficult to separate except by the presence or absence of larval head horns and some minor setal arrangements in the adults.

In the preceding discussion, special reference has been made to the vasiform type of antennal segment. Although such a feature is common in *Acanthothrips* and its derivatives, there are some species of *Acanthothrips*, such as *coriaceus*, which have the antennal segments more cylindrical than vase-shaped. Besides this antennal characteristic, *coriaceus* further differs from certain of its congeners, *nodicornis* and *albivittatus*, by having smaller eyes that are positioned slightly farther apart. By selecting the species *coriaceus* as the connecting link it is a simple matter to proceed backward to the species herein assigned to the genus *Hoplandrothrips*.

Species of *Hoplandrothrips* also have bean-shaped eyes, although in size they are not quite as large as in most *Acanthothrips*. As in *Acanthothrips coriaceus*, the eyes found in species of *Hoplandrothrips* are moderately far apart. Many males of *Hoplandrothrips* have spurs on the fore femora much as do some females and males of *Acanthothrips* and all males and females of *Neurothrips*. Since such spurs occur, although rarely, on males of *Phlaeothrips fungosus* of the Pacific Islands, it could

be concluded that a close relationship exists between *Neurothrips*, *Acanthothrips*, and *Hoplandrothrips* and between *Hoplandrothrips* and *Phlaeothrips*. In other ways the genus *Hoplandrothrips* also is referable to *Phlaeothrips*. There is only a gradual change backward from typical species of *Hoplandrothrips* to *Hoplandrothrips microps* to *Phlaeothrips karnyi*, through the rest of the species in *Phlaeothrips* to the *flavicauda* complex which contains *Phlaeothrips fungosus*. From *Hoplandrothrips* in a forward direction such genera as the Oriental *Ecacanthothrips*, the world-wide *Macrophthalthothrips* and *Poecilothrips*, and the Neotropical *Pristothrips* can be derived. Most of them seem to have specialized in their own directions from well-developed species of *Hoplandrothrips*. These latter named groups differ, almost always distinctly, from the *Hoplandrothrips*-like progenitor by one or two specialties such as an increase in the number of sense cones on the third antennal segment, holoptic eyes, or by the form of the mesosternum.

By these reasonings, the *Neurothrips* line can be traced back with reasonable certainty to typical species of *Phlaeothrips*, the group that was formerly called *Hoplothrips* and *Trichothrips*. Generally these *Phlaeothrips* species are small, without elaborate structures, without praepectal plates, with moderately small peltae, and with the slender maxillary stylets retracted usually far into the head and usually positioned close together in the center of the head (Fig. 67). However, one complex of species in the genus *Phlaeothrips*, the previously mentioned *flavicauda* complex, departs from the common type. These departures are seemingly of great importance phylogenetically.

In the *flavicauda* complex the range of variation of structures in the several forms of each species is striking. So radically do certain features vary intra- and interspecifically that this group could be related to many genera near *Phlaeothrips*. Even within one species, some forms may be more like one genus in a characteristic than another form of the same species which may be more like another genus because of a modification of the same characteristic. Variable structures considered were the pelta, head shape, and the presence or absence of praepectal plates.

Wingless forms of at least the species *flavicauda* and *fungosus* have a pelta that is fairly broad (Fig. 113). The winged form of *flavicauda* continues to have a similarly formed pelta. In contrast, the winged form of *fungosus* has a much reduced pelta which is small and triangular (Fig. 112). Changes of the pelta shape between forms of the same species is generally uncommon but it does occur also in *Sophiothrips* (Figs. 103, 104), and to a lesser degree in some other genera near *Phlaeothrips*. Seemingly the transition of the size of the pelta could have evolved rapidly even within a genus, although in most groups the pelta appears to have become smaller or larger more gradually.

Variations of head and prothoracic shapes are not confined to *flavi-*

*cauda* nor to *Phlaeothrips*; but in the *flavicauda* complex the difference in size of these parts of the body between the major and minor forms, particularly of the male sex, is remarkable for such tiny insects. Tendencies toward elongated heads, a supposed specialized characteristic, is already manifest in these somewhat primitive *flavicauda*-like species although this condition is not yet fixed in the species permanently. Occasionally spurs appear on the fore femora of major forms as though this latter feature was correlated somehow with macrocephaly. Undoubtedly these forms are produced by heterogonous growth, a phenomenon that occurs frequently in the *flavicauda* group, is of common occurrence in one sex of *Hoplandrothrips*, and always occurs in both sexes of *Neurothrips*. In other words, the larger the size of the species in this line, the more frequently these heterogonic features become fixed in the species.

Most species that belong to the *flavicauda* complex have praepectal plates. In contrast, most species of *Phlaeothrips* and their allies lack these structures. It is interesting to note, then, that in rare instances winged specimens of *Phlaeothrips flavicauda* may lack the praepectus. If the absence of praepectal plates in the Phlaeothripidae is a specialized characteristic by degeneration, it is of significance that the loss first occurs in the *Neurothrips* phyletic line in the winged form only. It is of significance because other specializations are often first found in the winged form such as the reduction in size of the pelta. Possibly the wingless form is more apt to show primitiveness or slight tendencies that much later develop more fully; winged forms may be apt to show more immediate changes that are rapidly becoming established in the phyletic line.

#### REDINTEGRATION

From these comparisons a prototype may be postulated as follows. It would have characteristics closest to those now found in *flavicauda*. However, some modifications should be made to account for features of the higher groups since *flavicauda* itself seems to have evolved considerably in a degenerate direction.

*Head.* Small, moderately reticulate, without cheek warts; eyes not enlarged; antennae inserted just below and behind fore margin of eyes; all antennal segments small, more or less globular; mouth cones short, blunt or even broadly rounded; maxillary stylets slender, retracted far into the head, not touching in the middle of the head.

*Thorax.* Praepectal plates present; mesopraesternum well developed; fore wings just slightly indented in the middle, moderate in width, fringe cilia probably moderately close together.

*Abdomen.* Pelta broad; tube short.

Perhaps a prototype of this sort produced the *flavicauda*-like species



which in turn produced the many species in *Phlaeothrips*. Later, forms similar to the generalized *Hoplandrothrips* were evolved. At that time, several side branches possibly appeared and genera such as *Malacothrips*, *Cephalothrips*, and *Adraneothrips* became separate as entities. Also near this point the *Idiothrips*-like species originated and produced the phyletic line that culminates in *Amphibolothrips*.

Most of the groups mentioned above evolved by the degeneration of parts; especially there was a tendency toward brachypterism, loss of reticulations, and modifications by reduction of many sclerites.

Through the generalized *Hoplandrothrips* another type of evolution occurred. The resultant genera added parts or elaborated upon the primitive structure. Genera such as *Macrophthalmothrips* and *Poecilothrips*, *Ecacanthothrips* and *Acanthothrips* came into being. From the *Acanthothrips* side of the main trunk, genera like *Eupathithrips* and its allies and *Neurothrips* and *Thilakothrips* specialized particularly by the enlargement of the cheek setal sockets into warts and by the change of the shape of certain antennal segments into vaselike shapes.

Very early in this line the praepectus was lost and the pelta was reduced in size. Some few species have become large but in the main the species have remained small or reached only a moderate size. The *Neurothrips* phyletic line embraces many species throughout the world; most of them are adapted to the temperate or tropical regions.

#### **Docessissophothrips Line**

Although not known until recently, the principal diagnostic characteristic of *Docessissophothrips*, the looped maxillary stylets (Fig. 81), is so unusual that this genus now stands out as one of the most spectacularly developed groups within the Phlaeothripinae. Long stylets seem to be one of the specialties of the Phlaeothripidae. It should follow then that extremely long, looped stylets are further specializations and the thrips in which they are found are at the apex of their phyletic line.

This line, somewhat like the *Neurothrips* line, contains only species that lack praepectal plates. The members of the *Docessissophothrips* line are grouped together because they have certain common tendencies. In their greatest development they tend to produce cheek pouches and long maxillary stylets, and almost always antennal segments VII and VIII become fused. Generalized complexes of this line grade into *Phlaeothrips*.

#### **RETROGRADATION**

Features of *Docessissophothrips* which may be compared with their relatives are:



*Head.* Usually with heavy cheek pouches behind the eyes (Fig. 81); maxillary stylets of the slender type but somewhat broader than normal for this type and extremely long; maxillary palps large; antenna seven- or eight-segmented; mouth cones broadly rounded.

*Thorax.* Praepectus absent; wings generally broad throughout.

*Abdomen.* Pelta small, generally triangular; tube not especially long, neither thick nor slender.

Except for the long maxillary stylets the type species of *Docessissophothrips* resembles *Polyphemothrips brasiliensis* (Fig. 80). These two species have heavy cheek pouches, antennae seven-segmented, broadly rounded mouth cones, broad wings, and slightly arched heads.

The thrips mentioned above are fairly large species. A smaller thrips with reduced cheek pouches that is definitely related is *Polyphemothrips minor*. This species was originally placed in the same complex with *brasiliensis*, although *minor* has reduced cheek pouches. Near *minor* are many other species of *Polyphemothrips* with even smaller heads and without cheek pouches. If the species of the latter genus were so arranged, a progression of head forms from the elongated heavy pouched types to the smaller types lacking cheek pouches would demonstrate the gradual changes still represented in our modern fauna.

Some of the least elaborate species of *Polyphemothrips*, such as *bratleyi* and *ambitus* and even *junctus* are, on one hand, similar to *Phlaeothrips angusticeps*, and on the other hand are similar to *minor*. *Phlaeothrips angusticeps*, which is placed in *Phlaeothrips* on trivial differences, also has a slightly arched head as do most *Docessissophothrips*-like species. The *Docessissophothrips* line merges with *Phlaeothrips* with scarcely any gaps between the links.

From species of *Docessissophothrips* back to *Phlaeothrips angusticeps* the changes have been (1) from large heads with heavy cheek pouches to smaller heads with no cheek pouches (Fig. 68), (2) from extremely long, slightly broadened maxillary stylets to moderately long, thinner stylets, (3) from reduced antennal segmentation to an antenna with eight segments, and (4) from large to small size. Throughout the line the praepectus is absent, and the pelta is small. Generally the tube is small, slightly thickened, often reddish or yellowish in color, tipped with grey, and usually the tube is not heavily sculptured although in a few species it may have ridges.

Other *Phlaeothrips*-like species with arched heads that are somewhat like *Polyphemothrips* are several species in the genus *Hoplandrothrips*, particularly *tumiceps* and *insolens*. These latter two species, the species *angusticeps*, and the smaller species of *Polyphemothrips* probably all arose from closely related ancestors. Without doubt the *Docessissopho-*

*thrips* line originated from a *Phlaeothrips*-like species, and its ancestors if traced back farther would resemble the prototype of *Phlaeothrips*.

#### REDINTEGRATION

By this analysis, the prototypes of the *Docessissophothrips* and *Neurothrips* lines would be similar if not identical. The immediate prototype of the *Docessissophothrips* line would differ slightly as follows:

*Head.* Small, but with a tendency to be slightly arched; antennal segments VII and VIII closely joined, with a tendency toward fusion of these two segments; maxillary palps large (Fig. 6).

*Wings.* Fore wings of uniform width throughout, slightly broadened.

*Abdomen.* Pelta considerably reduced; tube small, generally yellowish tipped with grey.

From this prototype, which in many ways resembles *Phlaeothrips angusticeps*, a form similar to *ambitus* or to the South American species of *Holothrips* may have arisen. Species such as *bratleyi* and *junctus* could easily have developed from an *ambitus*-like ancestor differing from it in the partial fusion of the terminal antennal segments.

As the line developed, the head probably elongated and cheek pouches were produced simultaneously with the lengthening of the maxillary stylets. An example of this sort of intermediate would be *Polyphemothrips tibialis* or *Polyphemothrips minor*. From them a number of larger forms, such as *brasiliensis*, may have evolved. Finally *Docessissophothrips* with its extremely long maxillary stylets and large cheek pouches resulted. A side branch culminating in the South American *Cordyllothrips* arose and specialized by increasing the number of antennal segments fused.

Throughout their evolution most of the species retained a broadly rounded mouth cone (Fig. 6). Rarely did the mouth cone become pointed. In addition, they did not develop unusual spurs or especially formed intermediate antennal segments. Although in their ultimate development they did not produce unusually adorned species, the peculiarly formed cheek pouches gives this line a distinction worthy of recognition.

For the most part the advanced species of this line are now found in South America; the more generalized species occur in the southern boundaries of the Nearctic region.

#### Amphibolothrips Line

Another genus in the family Phlaeothripidae which seems to be at the apex of a phyletic line is the genus *Amphibolothrips* containing ten subgenera: *Amphibolothrips* s. str.; *Baenothrips*, *Bebelothrips*, *Bradythrips*, *Conocephalothrips*, *Octurothrips*, *Stephanothrips*, *Trachythrips*, *Uro-*

*thrips*, and *Verrucothrips*. This line that in its ultimate development produced these unique subgenera, includes in addition those genera that have warty heads, small eyes, and are usually wingless. The specialized species tend to have many of the antennal segments fused and often bear prominent anterior head setae (Fig. 48).

#### RETROGRADATION

*Amphibolothrips*, formerly considered a separate family, Urothripidae, is an outstanding specialized genus because it has the following features:

*Head.* Surface covered with warts rather than reticulations or striations; many antennal segments frequently fused; in some species the actual number of separate segments is reduced to four; maxillary stylets slender, retracted far into the head.

*Thorax.* Pronotal epimeral sutures incomplete; mesosternum often fused to the metasternum; hind coxae spaced farther apart from each other than are the middle pair of coxae.

*Abdomen.* Tube with extremely long anal setae (Fig. 2).

As is the case in most apterous thrips, individuals of this genus have many degenerate structures. The reductions and fusions of parts mentioned above are degenerations peculiar to *Amphibolothrips*. Other conditions found in *Amphibolothrips*, such as the small number of eye facets, the loss of ocelli, the simplified form of the thorax, and the nondifferentiation of abdominal setae as wing-retaining setae, often occur presumably as parallelisms in wingless forms in other genera on most of the phyletic lines. Inasmuch as these latter degenerations are likely to be found elsewhere, they are not especially emphasized here in considering the *Amphibolothrips* line alone.

Before comparing *Amphibolothrips* with other genera it is best to examine *Amphibolothrips* itself in order to select its most primitive representative. The subgenera may be arranged according to the number of antennal segments, from *Amphibolothrips* s. str. and *Stephanothrips* which have only four or five segments, to *Trachythrips* which has five or six segments, to *Urothrips*, *Bradythrips*, *Baenothrips*, and *Conocephalothrips* which have seven segments, and finally to *Verrucothrips* and *Octurothrips* which have eight segments. It is doubtful that these subgenera arose in a straight sequence because other characteristics—for example, the number of long anal setae and the number or absence of prominent anterior head setae—do not follow a corresponding straight-line pattern.

On the basis of the form of the antenna, it is reasonable to presume that the two subgenera with eight antennal segments are the more primitive since the generalized Terebrantia have eight or nine segments.

Of the two, *Octurothrips* has the third antennal segment shaped more like that in many Phlaeothripidae and less like that in the other *Amphibolothrips*. Also *Octurothrips* has six major anal setae, which is the general condition in other genera of Phlaeothripidae. On the other hand the last three antennal segments of *Octurothrips* are closely joined, whereas in *Verrucothrips* these segments are more separated as in primitive Terebrantia and in most Tubulifera. *Octurothrips* lacks prominent anterior head setae but *Verrucothrips* has three pairs of such setae. In order to draw up a prototype, features of these two subgenera may be combined to produce a form which has the third antennal segment like *Octurothrips* but the last few segments would be like that of *Verrucothrips*, the long anal setae would be six in number, and the head could be with or without prominent anterior setae. All remaining characteristics could be similar to the usual features of *Amphibolothrips*.

Genera of Phlaeothripidae with affinities to this *Amphibolothrips* prototype but which contain less specialized species are *Hoodiana* and *Idiothrips*. Probably these genera are side branches of the *Amphibolothrips* line. However, it makes little difference whether or not all of these genera are directly related or whether they merely exhibit interesting examples of parallel evolution. In either case the variations in their structures demonstrate how the specialized developments could have come about.

Possibly the next in line backward from *Amphibolothrips* is the African genus *Hoodiana*. At the time of its description it was placed with *Amphibolothrips* as an Urothripidae. Like *Amphibolothrips*, *Hoodiana* has a warty body, possibly the slender maxillary stylets retracted far into the head, the prothoracic epimeral sutures are incomplete, and the mouth cone is broadly rounded. In *Hoodiana* each antenna is somewhat similar to the composite antenna proposed for the *Amphibolothrips* prototype. Unlike *Amphibolothrips*, in *Hoodiana* the anal setae are short and the hind coxae are no farther apart than the middle pair. On this latter point *Hoodiana* is intermediate between *Amphibolothrips* and the rest of the Phlaeothripidae which have the hind coxae closer together than are the middle pair. *Hoodiana* does not have prominent anterior head setae. If *Hoodiana* is a living remnant of a type that produced *Amphibolothrips*, then their ancestor lacked a long tube and abdominal segment IX was not much longer than VIII. *Amphibolothrips* has an unusually lengthened segment IX; *Hoodiana* and other Phlaeothripidae do not.

To trace the characteristics backward to even more generalized forms, the rough-bodied *Idiothrips* was considered. Between *Idiothrips* and *Hoodiana* there is a slight gap. In *Idiothrips* wings appear occasionally, the mouth cones are pointed, and the praepectal plates are gone. The majority of species of *Amphibolothrips* have praepectal plates; in some *Stephanothrips* and in *Baenothrips* these plates are reduced or absent.



Most importantly, in *Idiothrips* the prothoracic epimeral sutures are sometimes complete (Fig. 46), and there is a large but differentiated pelta on abdominal segment I (Fig. 106), prominent anterior head setae are present occasionally in *Idiothrips* subgenus *Strepterothrips* (Fig. 46), and the hind coxae are typically close together.

Without excessive speculation, it has been fairly simple to connect most of the features of *Amphibolothrips* to *Hoodiana* and then to *Idiothrips*. Few discontinuities are noticeable in tracing back the structures. Even though *Idiothrips* is a normal Phlaeothripidae in most respects, it too has tendencies which crop out again in *Amphibolothrips*. In *Idiothrips* the terminal antennal segments often fuse, prominent anterior head setae that are like the type found in *Amphibolothrips* subgenus *Verrucothrips* occasionally appear, and the prothoracic epimeral suture may partially fade. It is not unreasonable to postulate that the rough, hexagonal reticulations of many *Idiothrips* could easily transform into the warty condition found in *Amphibolothrips*. In general appearance *Idiothrips* and its subgenera are highly suggestive of *Amphibolothrips* (compare Figs. 46, 48, 49).

As to the features of *Amphibolothrips*, it is suggested that the warty condition could have come from hexagonal reticulations that had become rough, that several of the peculiarities of appearance are due to degeneration by apterism, and that the peculiar form of the notum of abdominal segment I came from large peltae that continued to enlarge. Since *Amphibolothrips*, which is so unusual, has praepectal plates, whereas *Idiothrips*, which is less spectacular, has no praepectal plates, it seems possible that the ancestor of both genera had these plates. *Idiothrips* independently lost them; *Amphibolothrips* rarely lost them.

*Idiothrips* could have arisen and probably did arise from a primitive *Phlaeothrips*. Aside from the roughened head, *Idiothrips* has much in common with primitive species of *Phlaeothrips*. Such a relationship seems plausible in explaining the presence of praepectal plates in the end product of this line, *Amphibolothrips*. Several primitive *Phlaeothrips*, such as *flavicauda* and *fungosus* have well-developed praepectal plates. This condition could have continued throughout the line, except in those species which lost these plates by degeneration.

#### REDINTEGRATION

As pointed out elsewhere, the primitive *Phlaeothrips* gave rise to a number of diversified lines. Almost certainly one of those lines produced was *Amphibolothrips*. In tracing back *Amphibolothrips* no ancestor seems better qualified than the *Phlaeothrips* prototype. From that prototype came a prototype which could have had the following characteristics, as based on the results of the comparative back-tracing:

*Head.* With hexagonal reticulations, moderate-sized eyes, maxillary stylets retracted far into the head, more or less rounded mouth cones, and each antenna eight-segmented.

*Thorax.* With complete prothoracic epimeral sutures, praepectal plates developed, a suture between the meso- and metasterna, hind coxae closer together than are the middle pair.

*Abdomen.* With a fairly large pelta, with segment IX no longer than VIII, with six short major anal setae. No males had glandular areas on the sternum of segment VIII.

From this prototype, forms similar to the intermediate between *Phlaeothrips* and *Idiothrips* could have developed. At this point the maxillary stylets were retracted farther into the head, apterism had become common, the reticulations were becoming rough, and permanent reductions of parts of the thorax were evident.

Of the earlier types that followed, one was somewhat like *Idiothrips*. Unlike *Idiothrips*, the hypothetical ancestor of *Amphibolothrips* had praepectal plates and the mouth cones remained rounded and never did become pointed. In this ancestor further degenerations and specializations appeared. Of the degenerations may be mentioned the tendency for the prothoracic epimeral sutures to be reduced (Fig. 47), for the eyes to become even smaller, and for the prothoracic sterna to start to fuse. The specializations were the appearance of prominent head setae, the broadening of the pelta, and the movement of the antennae backward onto the venter of the head to become inserted below and not forward of the head. Still the hind coxae had not moved sideways.

From this type there came about a species not much different from *Hoodiana*. By then the body was very warty, the hind coxae were moved slightly sideways, and probably the pelta was much larger and nearly covered the entire notum.

Finally the *Amphibolothrips* prototype appeared. This prototype gave rise to the ten subgenera and probably more. All of the new groups had tendencies toward the fusion of antennal segments.

Meanwhile, as offshoots, *Rhopalothrips*, *Froggattothrips*, and *Scopaeothrips* evolved. Except for the position of the hind coxae, these genera specialized along the same general lines followed by *Amphibolothrips*. Loss of praepectal plates, production of body warts, and enlargement of the pelta were some of the features that may have become fixed in their ancestors before these two groups diverged. Even the color patterns of these genera have remained similar.

Some of the same evolutionary tendencies inherent in the *Amphibolothrips* line occur in other lines, particularly in the *Neurothrips* line. Because both of these lines are closely related and probably had the

same common *Phlaeothrips* ancestor such parallelisms can be expected.

Although species of *Acanthothrips* and *Neurothrips* have pointed mouth cones, lack praepectal plates, and are heavily reticulated, it is highly unlikely that *Idiothrips* which has these same characteristics derived them from the *Neurothrips* line. It is unlikely because the *Neurothrips* line, except at the base, has a small pelta. If *Idiothrips* developed directly from them, the pelta would have gone through a period of reduction; then the tendency would need to be completely reversed to cause the pelta to enlarge in size. To postulate such a theory involving a turn-about in evolutionary trends is to seek the most complicated explanation. Rather, since both of the lines had a common ancestor, it is simpler to trace both lines back to this ancestor, and reversed trends need not enter into the explanation. In the *Neurothrips* line the pelta was reduced from a broad type; in the *Amphibolothrips* line which includes *Idiothrips* the pelta enlarged from the broad type.

Originally in the literature *Idiothrips* subgenus *Strepterothrips* was related to the tribe Phlaeothripini which at the time contained what is called here *Acanthothrips*, *Neurothrips*, *Hoplandrothrips*, and others. As mentioned above, *Idiothrips* could hardly have been derived from such specialized forms.

*Amphibolothrips* reaches its greatest diversity in the tropics. Some species have entered the warm temperate zones and except for one doubtful record they never occur in the cool temperate or arctic zones. Strangely, no *Amphibolothrips* has been found as yet in the Oriental region. The more primitive genera of this line possibly were warm-adapted also.

### Gigantothrips Line

Unlike most Phlaeothripidae, which are fungus feeders, many members of the *Gigantothrips* line feed on the juices of living leafy plants and some species of this group apparently produce galls by their own influences. Besides having the gall-making habit, thrips of this line tend to have large eyes, transversely striate head, somewhat twisted striae on the pronotum, and often they attain large size.

#### RETROGRADATION

In North America the most specialized member of this line is *Gigantothrips*. By contrast to the generalized structures of the Heliothripini, *Gigantothrips* has the following advanced features:

*Head.* Elongate, dorsal surface transversely striate; eyes large, spaced fairly close together; intermediate antennal segments elongate.

*Fore wings.* Broad, with fringe cilia closely spaced.

*Abdomen.* Pelta triangular, as in Fig. 120; tube extremely long, bent, and hairy.

Although there is now a wide gap between *Gigantothrips* and *Gynaikothrips* the logical step backward is to the latter genus. Both of these genera have broadly rounded mouth cones, slender maxillary stylets, similarly formed wings, and somewhat similarly formed pelta. *Gynaikothrips* is more conservative in its structures. Its tube, while moderately long, does not attain the extreme length found in *Gigantothrips*. Males of at least some *Gynaikothrips* have glandular areas as do males in the *Phlaeothrips* stems.

Nearest *Gynaikothrips* in relationship are species of *Holopothrips*. Some species of the latter genus have such large eyes that an holoptic condition is approached. Because of the eye form, *Holopothrips* could be considered more spectacular or specialized than *Gynaikothrips*. On the other hand *Holopothrips* has a shorter tube, which may be a primitive condition. Except for the above points and several minor differences, females of *Holopothrips* closely resemble females of *Gynaikothrips*.

Males of *Holopothrips* are remarkable, differing from most other Phlaeothripidae by the number and placement of abdominal glandular areas. *Holopothrips*, *Aliothrips*, *Plagiothrips*, *Phraстерothrips*, and *Trichinothrips* are the only genera of Phlaeothripidae that I know of which have male glandular areas on more than one abdominal sternite. Often these areas consist of spots arranged in rows each on sternites VII and VIII. All of these genera are related and belong in the same complex.

Undoubtedly certain of the Oriental genera that cause galls belong to this line and should be considered also. In lieu of the Oriental species, which are not available to me at present, *Gynaikothrips* and *Holopothrips* were compared to more distant relatives in the genus *Liothrips*.

Species of *Liothrips* also may feed on plant juices. They are similar to *Gynaikothrips* in the general form of the head, antennae, and most other body features, including the loss of praepectal plates. Unlike *Gynaikothrips*, *Liothrips* usually has pointed mouth cones. Certain more primitive *Liothrips*—especially those that grade into *Phlaeothrips*, such as the species *longitubus*—do not have pointed mouth cones; instead these structures more nearly approach the condition found in many *Phlaeothrips* and in *Gynaikothrips*. On the basis of the form of the mouth cones, *Gynaikothrips* is linked to *Liothrips* through the generalized species rather than by way of the specialized *Liothrips*.

#### REDINTEGRATION

As in many of the other lines discussed, the *Gigantothrips* line seems to stem from the generalized *Phlaeothrips*. The ancestor of *Phlaeothrips*



as proposed in the account of the *Neurothrips* line would qualify here just as reasonably.

From that ancestor a form similar to *longitubus* might have been produced. At about this juncture the living leaf sucking habit may have arisen to produce, on the one hand, genera with broadly rounded mouth cones such as *Gynaikothrips* and *Holopothrips*, and on the other hand, those species with long pointed mouth cones such as *Liothrips*. From the *Gynaikothrips* side the long-tubed *Gigantothrips* may have evolved.

Although the most extremely developed species are tropical in distribution, the more conservative members such as some *Liothrips* are found in temperate regions.

### Haplothrips Line

#### RETROGRADATION

No one particular genus in this line is outstanding as containing extremely specialized members. *Podothrips*, whose species have the prothorax elongated, or *Goniorthrips* or *Agrothrips*, whose representatives have certain segments of the antennae peculiarly formed, may be about as highly developed as any in this group.

Nevertheless as a starting point, a species like *Haplothrips mali* (formerly *Leptothrips mali*) may be selected. This species has the head and the intermediate antennal segments elongated, the eyes are ventrally prolonged, the mouth cone is pointed, and praepectal plates are present.

Through *mali* the next logical step backward is to the rest of the *Haplothrips*. The transition is a gradual one. Species such as *distalis* of the southwestern United States closely resemble *mali* except that in *distalis* the head and antennal segments are shorter, and the eyes are less prolonged posteriorly on the ventral surface of the head. It is a simple matter to connect *distalis* with the more typical *Haplothrips*, especially those species that inhabit flowers. The progression backward is toward a smaller head, shorter antennal segments until very short globular intermediate segments are reached, from pointed mouth cones to mouth cones that are broadly rounded, and from larger thrips to smaller ones.

Nearer the main body of *Haplothrips* that are like the type species, there are several complexes which are more degenerate. Forms such as *longiceps* often become wingless and lose much of the body reticulations, but on the other hand they develop occasionally longer setae at the apex of the tube. Other relatives such as the species of the genus *Bagnalliella* specialized to exploit restricted habitats—in the case of these species, the habitat of *Yucca* plants.

Even more degenerate forms such as *Lispothrips* have developed and prospered in the cool zones of the North. The genus *Lispothrips* possibly may be connected directly to the *Haplothrips* through such forms as the European *Haplothrips alpester*. Although it is not generally known, winged forms of *Lispothrips* do exist, and it is interesting to note that their fore wings are indented in the middle just as in *alpester* and other *Haplothrips* and the heads of these winged forms are not as rough as in the wingless stage.

Within *Haplothrips*, species can be found to show that the genus is definitely linked to *Phlaeothrips* and other related genera. For instance the genus *Adraneothrips*, while it is in many ways suggestive of *Malacothrips* and *Hoplandrothrips*, is also similar to *Haplothrips* by the characteristic of the wide maxillary bridge and, especially in the wingless stages, by the similarity of tendencies and over-all form.

In many points the genus *Haplothrips* is nearest *Phlaeothrips*. Species that may be selected to demonstrate the close transition between these two subgenera are *Haplothrips pullatus* and *Phlaeothrips flavicauda*. Both species have praepectal plates, somewhat broadened pelta, and similar basic structures. The assignment of *pullatus* to *Haplothrips* can be made on the trivial characteristic of the minuteness of the mid lateral prothoracic setae because this characteristic is a *Haplothrips* tendency. The species *flavicauda* belongs to *Phlaeothrips* because of its tendency to produce major forms, a characteristic of the genus *Phlaeothrips*. Admittedly such separation is weak, but because there exists this difficulty of placing these species, the concept that they are closely related is strengthened.

Below or in the region of the junction of *Phlaeothrips* and *Haplothrips*, *Lissothrips* seems to take its position. The separation of *Lissothrips* as a full genus may be no longer appropriate since the discovery of an undescribed Jamaican species which is before me. Originally *Lissothrips* was erected as a genus because the third antennal segment was extremely small. Because the Jamaican species is so similar to *Lissothrips muscorum* (the type species of *Lissothrips*) except for the larger third antennal segment, the former gap between *Lissothrips* and *Phlaeothrips* may be bridged.

#### REDINTEGRATION

In analyzing this line, the primitive or less specialized entities seem to belong to *Phlaeothrips* and to *Lissothrips*. Thus the basic prototype proposed for the *Neurothrips* line as well as for the *Amphibolothrips* and *Docesissophothrips* lines would be the same as the prototype of the *Haplothrips* line.

From that prototype *Haplothrips* arose and for the most part retained praepectal plates. The other lines arising from the same prototype lost these plates early in their evolution. On the whole, *Haplothrips* developed a noticeable constriction in the middle of the fore wings and a wide maxillary bridge became a dominant feature. Primitive *Haplothrips* possibly were the progenitors of several degenerate branches which as yet are not distinct enough to be classed as genera except for *Lispothrips* and *Bagnalliella*. Other *Haplothrips* species developed longer heads with pointed mouth cones, such as *mali*.

Generally this group did not diverge far from the basic structures of the prototype. Except in rare instances the tube remained small; there was little tendency toward the addition of body adornments or spectacular modifications of the head, antennae, or thorax; and the markings of the head were almost always in the form of striations rather than hexagonal reticulations. Their evolutionary development was a conservative one.

### Glyptothrips Line

This group contains all those genera assigned to the tribe Glyptothripini (Stannard 1955a).

#### RETROGRADATION

The most specialized members of this line, *Orthothrips* and *Chamaeothrips*, are found in the Neotropical region. Their greatest specialization is in the elongation of the tube, the reduction of the postocular setae, and the reduction of the major setae on the posterior margin of abdominal tergite IX.

Individuals of this line have keglike eyes, usually have praepectal plates, and are often heavily reticulate. There are at least fifteen genera in the world which can be assigned to this tribe and all but a few have representatives in North America.

One of the most advanced species in the New World is *Orthothrips dubius* from Mexico. Its specialized characteristics are:

*Head*. Intermediate antennal segments with elongated pedicels; postocular setae minute.

*Thorax*. Praepectus absent; fore wings moderately wide but not broad.

*Abdomen*. Pelta small; wing-holding setae slightly expanded; middle pair of posterior setae on the dorsum of segment IX short; tube long in female.

Except for the aforementioned characteristics, *dubius* is like most *Erkosothrips* or even *Eurythrips*. It is heavily reticulate, has a broadly

rounded mouth cone, the fore part of the head is slightly produced beyond the eyes and the mesopraesternum is well developed.

Perhaps the species *Chamaeothrips decoratus*, also from Mexico, is equally specialized. In this species the praepectal plates are present but the last two antennal segments are fused and the wing-retaining setae are not expanded.

Using either species—*dubius* or *decoratus*—as the starting point, it is a small step backward in a comparative sense to the species *Orthothrips boneti*. In this species the tube is slightly smaller especially in the male, and the antenna is shorter. There is but a gradual change from *Orthothrips boneti* back to the typical species of *Eurythrips*. These two genera differ mostly in the size of certain body spines and in the length of the tube, but even in these characteristics there is no outstanding abrupt break.

The more specialized genera contain heavily reticulated species (Fig. 61). Another side branch contains species that are less reticulated and exhibit other signs of degeneracy (Fig. 59). For example, *Eurythrips ampliventralis*, *E. hindsii*, *E. watsoni*, and others are only weakly reticulate and often the epimeral sutures of the pronotum have become incomplete (Fig. 60). These species also have fairly short tubes. The prototype of this line probably was intermediate between those species that are elaborately hexagonally reticulate and those species that now are hardly at all marked.

#### REDINTEGRATION

The prototype of *Eurythrips-Erkosothrips* could have had the following characteristics:

*Head.* Slightly produced in front of the eyes; cheeks slightly incut behind the eyes; mouth cones broadly rounded; maxillary stylets slender, retracted into the head a moderate distance.

*Thorax.* Epimeral sutures complete; praepectus present; mesopraesternum well developed; fore wings moderately wide.

*Abdomen.* Pelta somewhat broad; tube moderate in size.

This prototype, a close relative of the *Phlaeothrips* prototype, was probably distinctly marked by hexagonal reticulations and the males had a glandular area on abdominal sternite VIII.

Most likely in the early development of this prototype two branches diverged. One branch, while retaining primitive characteristics such as the shorter tube and longer body setae, soon became degenerate in respect to the body sculpture and the partial loss of the epimeral sutures. That branch produced such species as *Eurythrips ampliventralis*, *E. tarsalis*, *E. virginianus*, etc. The other branch retained the heavy body



sculpture, the size of the body setae was reduced, and the tube tended to become longer. That branch produced species like *Erkosothrips floridensis* (Fig. 61).

From *floridensis*-like species, longer-tubed species eventually evolved, as, for example, *Eschatothrips barythripoides*. At about this point *Glyptothrips flavesceus* may have diverged. It was distinctive in having each antenna reduced to seven segments. From these longer tubed *Eschatothrips*, species of *Orthothrips* may have originated. Some of them specialized by the fusion of the basisternal plates (Fig. 25), or by the loss of praepectal plates, or by the fusion of antennal segments VII and VIII.

Representatives of this line occur in both the tropical and temperate regions. The more primitive members, such as the reticulate species of *Sagenothrips* or *Erkosothrips*, are most commonly found in the warm temperate or subtropical zones. The more specialized *Orthothrips* and *Chamaeothrips* are distributed in tropical areas. They are found in dead leaves or in dead grass clumps.

### Williamsiella Line

Members of this line are unusual in that the maxillary stylets barely retract into that part of the head that is exposed dorsally (Fig. 40). Many of them are degenerate and many of them have antennal segment III reduced in size.

### RETROGRADATION

The genus *Williamsiella* is extremely specialized by degeneration. Its specialized characteristics are:

*Head.* Eyes small, composed of but a few facets (Fig. 40); postocular setae long; each antenna seven-segmented.

*Thorax.* Reduced; apterous; praepectus present; mesopraesternum degenerate.

*Abdomen.* Pelta broad but reduced at posterior margin (Fig. 100); tube short.

*Williamsiella* and the near related *Phthirothrips* and *Zaxenothrips* have heavy, broadly rounded mouth cones and are weakly sculptured. They resemble the slightly less degenerate genus *Lissothrips*. *Lissothrips*, while a close relative of this line, is not truly a part of it because in *Lissothrips* the maxillary stylets retract moderately far into the head. Nevertheless, *Lissothrips* and other primitive groups near *Phlaeothrips* undoubtedly were derived from the same common ancestor that produced the *Williamsiella* branch.

*Sophiothrips* also is seemingly related to *Williamsiella*. Winged forms of *Sophiothrips* are less degenerate and less specialized in many respects. Notably, in some winged species of *Sophiothrips* the praepectal plates are present, the pelta is of the large type, and antennal segment III is not greatly reduced.

From within this line the genus *Antillothrips* may have had its beginning. *Antillothrips* has a longer head and somewhat resembles species in the genus *Haplothrips*. Like the rest of the genera of this line, *Antillothrips* has short maxillary stylets, but it may not be as closely related to the others as *Williamsiella*, *Phthirothrips* and *Sophiothrips* seem to be to each other.

#### REDINTEGRATION

Because of the difficulties in comparing apterous species with macrop-terous species it is not feasible to group this line in a linear arrangement. Instead, a composite of all of them was used to formulate the prototype which might have been as follows:

*Head*. Short, oval; eyes moderate in size; antennal segment III sub-equal or slightly longer than segment IV; cheeks slightly incut behind eyes, or with only a tendency toward this condition; mouth cones rounded; maxillary stylets slender, not retracted far into the head.

*Thorax*. Praepectus present; mesopraesternum well developed; fore wings moderately wide but with a tendency to be indented in the middle.

*Abdomen*. Pelta broad; tube moderate in size.

Undoubtedly this prototype was well sculptured with hexagonal reticulations. Such an ancestor might have resembled the *Phlaeothrips* ancestor in most ways. It undoubtedly radiated into several descent lines. One of them may have become the forerunner of *Phlaeothrips*, which in turn also produced, by degeneration, *Williamsiella*, *Zaxenothrips*, *Bagnalliola*, and *Phthirothrips*. *Antillothrips*, a less degenerate type, may have arisen at the same time. *Sophiothrips* seemingly represents another divergent line stemming from this ancestor. From *Sophiothrips*, *Plectrothrips* may have diverged.

Either before or after this ancestor evolved, several other genera probably came into existence. *Pueblothrips*, for example, may be derived from one of the most generalized genera of the Phlaeothripidae although at present it is slightly degenerate by the loss of praepectal plates and sculpture. It seems to belong to the *Williamsiella* line. From *Pueblothrips*, *Preeriella* and *Hydiethrips* may have arisen.

Species of this line and species of related genera are confined to warm temperate or tropical regions. It might be supposed that they originated in a warm region and have remained there ever since.

### Hydiorhrips Line

This line is composed of but a few genera, *Hydiorhrips*, *Chiorhripoides*, *Smiorhrips* and *Preeriella*. They are very small slender thrips with extremely narrowed wings, a transverse ridge across the pronotum, and the meso- and metafurca connected by a longitudinal apodeme.

*Hydiorhrips* is one of the more specialized of these genera. It is more specialized because often the third and fourth antennal segments become fused, and because many of the body setae are unusually dilated at the tip.

As presently known, the recognized species, except perhaps *tesselatus* which is unknown to me, have fairly long slender maxillary stylets, the mouth cone broadly rounded, praepectal plates present, and the pelta broad although subdivided into three parts (Fig. 101). Presumably their ancestor had these conditions.

It is difficult to place this group. They can hardly be connected directly with any other group, yet at the same time they are not radically different from the generalized *Phlaeothrips* or generalized individuals of the *Williamsiella* line. They seem more different than they really are because they are so slender. Possibly *Preeriella* and *Hydiorhrips* and the others arose from an early group of Phlaeothripinae which also soon produced the *Williamsiella* line, the *Phlaeothrips*-like lines, and the *Plectrothrips* line.

### Plectrothrips Line

In North America this line contains only one or two genera, mainly *Plectrothrips*. It is a distinctive line because the species have a peculiarly reduced pronotum (Fig. 43), a basal sensorium on antennal segment II, and the larvae have a spurlike comb on abdominal segment IX. This line is less distinctive when the European *Eurytrichothrips* is considered. *Eurytrichothrips* has a normally formed pronotum.

In most features *Plectrothrips* is remarkably similar to *Sophiorhrips* of the *Williamsiella* line. *Sophiorhrips* even has the sensorium of antennal segment II placed toward the base of that segment. Unlike *Sophiorhrips*, *Plectrothrips* is less reticulate and the maxillary stylets retract far into the head. Slender apical antennal segments as found in *Plectrothrips* also are found in *Sophiorhrips*, *Hydiorhrips*, *Preeriella*, and *Pueblothrips*.

On the basis of general appearance and since neither has unusual structures that would necessitate another conclusion, it is reasonable to suppose that *Plectrothrips* arose from a *Sophiorhrips*-like ancestor.

The *Plectrothrips* line reaches its greatest development in Australia and in the Orient.

## SUMMARY OF THE PHYLOGENY

That the family Phlaeothripidae is conceded to be sufficiently distinct to be set apart as a suborder from the other families is in itself an indication that it has diverged radically from the rest of the Thysanoptera. Each of the other families, while probably specialized in its own way, presumably has retained many basic features of the primitive thrips. The family Phlaeothripidae has either lost some of these features or elaborated upon them.

It seems likely that the family Phlaeothripidae was derived from the Terebrantia. As outlined in the foregoing discussion of the phylogeny, the ancestor of the Phlaeothripidae may have stemmed from a generalized group of the family Thripidae, presumably from the Heliothripini.

During the early stages this ancestor possibly resembled the tubed heliothripine, *Dinuurothrips*. In time the group lost the sawlike ovipositor and gained structures that no other group developed. As yet no intermediates, fossil or living, have been found to positively connect a *Dinuurothrips*-like species with a primitive Phlaeothripidae, but these two groups have so much in common that it is reasonable to suppose that such a connection occurred.

Of all of the proposed ancestors of the various lines, none seems closer to the Heliothripini than does the ancestor of the *Williamsiella* line. From such a supposed ancestor the other lines could have evolved. Besides, the other ancestors are remarkably close to the *Williamsiella* prototype and differ in but a few minor points.

By comparing each prototype of the several lines with the *Williamsiella* ancestor, a hypothetical ancestor of the Phlaeothripidae was reconstructed embodying the following characteristics:

*Head.* Oval, reticulate; eyes moderate in size; not greatly extended on the ventral surface; antennae inserted on the ventral surface but near the anterior margin of the head; antennae each clearly eight-segmented, each segment more or less globular to oval, segment III about as long as segment IV, with but two or three well-developed sense cones on segment III and with the sensorium of segment II positioned near the apex; fore ocellus slightly overhanging; postocular setae moderately developed.

*Mouth parts.* Mouth cones broadly rounded; maxillary stylets slender, not retracted much into the head; maxillary pillars short; maxillary and labial palps each two-segmented.

*Thorax.* Notum hexagonally reticulate; pronotum with complete epimeral sutures; praepectus present; prospinasternum small; mesopraepectum well developed; mesospinasternum fused to the metasternum; fore tarsus one-segmented, possibly with a subapical or apical spur; all



other tarsi two-segmented; fore wings moderately wide, possibly wider at the base, without complete veins, and with accessory fringe cilia.

*Abdomen.* Hexagonally reticulate on the entire dorsum of segment I, and on the sides of segments II to IX; tube possibly marked with scallops or reticulations; pelta differentiated, of the broad type; tube moderate in length.

This hypothetical prototype resembles certain extant Heliothripini in the form of the head, the antennae, the shape of the mouth cones, the body reticulations, and in having the last segment of the abdomen formed into a tube. It differed from all modern species of the Heliothripini in the formation of the mouth parts, certain sclerites of the thoracic sterna, in the wings, the legs, the development of the pelta, and in the distinctive shape of the tube.

For the most part, the differences of the legs, wing, and pelta are degenerative changes. By contrast, the development of maxillary pillars and the formation of praepectal plates and a mesopraesternal sclerite are innovations to the Thysanoptera. They are additions to the feeding apparatus and strengthening plates for the movement of the head and fore legs. Presumably then, the Phlaeothripidae invaded and were able to exploit a new feeding zone. The main body of the Terebrantia continued to live in the living leaf and flower habitats whereas the Tubulifera branched off principally into the fungus habitat.

In entering this new zone the emergent Phlaeothripidae met with new environmental pressures. Many of them became flattened to enter into tight places under bark to better search for spores. With ample supplies of food, they developed the tendency to grow tremendously in certain body regions. Because, in the development of these major forms, they often lost their wings, it is not clear how such a type of development was to their advantage.

Thus the Phlaeothripidae soon differed from the Terebrantia principally in their mouth structure, their habitat, and their ability to produce forms by heterogonous growth. Once established in their new zone they quickly diverged and radiated into a number of phyletic lines. By at least the Oligocene they were a full-fledged family (Priesner 1924a).

There are three primary groups surviving today which seemingly diverged in the initial flowering of the family. One of these groups has tended to retain the short maxillary stylets of its ancestors. This first division may have given rise to the *Williamsiella*, *Plectrothrips*, and *Hydiiothrips* lines.

The second group to emerge may have been the ancestor of the *Phlaeothrips* branches. Initially, it probably differed little from the other two prototypes but it soon became markedly specialized. This *Phlaeo-*

*thrips* ancestor eventually produced lines in which the praepectal plates were lost, heterogonous development was pronounced, and, in the males, glandular areas evolved, and the lateral setae of abdominal segment IX became short and spinelike. No male in the *Idolothrips* line or Megathripinae has these setae so modified.

The third group that arose at about the same time had many qualities ascribed to the *Phlaeothrips* ancestor with but two major exceptions. Instead of retaining slender maxillary stylets, it developed thicker ones, and possibly it lost or never developed male glandular areas. This third group led to the *Idolothrips* line.

Almost certainly the first group is composed of several elements. *Pueblothrips*, which is related to several fossil genera, might be the most primitive living Phlaeothripidae. Because in its evolution it has become degenerate, it is difficult to fix its exact relationship with the other thrips having short stylets.

Within this first group another side line developed to produce *Williamsiella* and allied genera. The rectilinear trends of this side line were toward a reduction of the size of the third antennal segment, toward complete apterism and a loss of sculpture, and for the development of long body setae. Unlike most Phlaeothripidae they evolved to feed on mosses rather than on fungus spores.

Sculptured, winged *Sophiothrips* exhibit a more generalized appearance than the related *Williamsiella* offshoot. However, *Sophiothrips* does produce degenerate individuals which are remarkably similar to representatives of the rest of the *Williamsiella* line. Possibly elements of *Sophiothrips* are slightly more advanced than the ancestor of *Pueblothrips* but less advanced than the *Phlaeothrips* lines. From a *Sophiothrips*-type progenitor the *Plectrothrips* and *Hydiorhrips* lines might have developed. Both *Sophiothrips* and *Williamsiella* have the sensorium of antennal segment II situated away from the apex of that segment. *Plectrothrips* carried this trend even farther; its sensorium now is positioned near the base of the second segment. Furthermore, *Plectrothrips* specialized by reducing the size of the pronotal sclerite. *Hydiorhrips* became specialized by reducing the wing width, by developing a tendency for antennal segments III and IV to fuse, and by developing unusually shaped body setae.

Between the *Williamsiella* side and the *Sophiothrips* side a generalized thrips developed to eventually produce the *Phlaeothrips* branches. Some of the early members of this line may have been like the moss-feeding species of *Lissothrips* which, because they also inherited tendencies for the reduction of antennal segment III, are still close to *Williamsiella* et al. By the time *Lissothrips* evolved, the maxillary stylets had greatly lengthened.

With the emergence of such forms as *Lissothrips* and the *flavicauda* complex of *Phlaeothrips* there seems to have been another proliferation of divergent types. Undoubtedly this was the main evolutionary burst that produced the principal and largest phyletic lines. The major division occurred between the *Phlaeothrips* branches and the *Idolothrips* line.

Most of the *Phlaeothrips* branches may have originated at this time. All of them stemmed from an ancestor that had inherent tendencies toward the production of male sternal glands. To one side the *Glyptothrips* line started and to another side the *Haplothrips* line diverged. Except in rare instances neither of these two lines tended to develop extremely long stylets, nor did they develop extreme forms by heterogonous growth.

Meanwhile the main body of *Phlaeothrips* continued to evolve and produce other offshoots. Two of the types that next may have diverged were the ancestors of the *Gigantothrips* and *Docessissophothrips* lines. Both stemmed from representatives that may be like certain elements grouped in *Phlaeothrips*. In the *Gigantothrips* line, major forms by heterogonous growth rarely developed. They gain their distinction from their propensity to revert to the living leaf habitat to produce galls. The *Docessissophothrips* line and the main body of *Phlaeothrips* continued to exploit the fungus habitat. *Docessissophothrips* eventually developed the longest stylets known in the Thysanoptera.

The origin of the *Neurothrips* and *Amphibolothrips* lines came about subsequently. *Neurothrips* developed from the side that produced warty-cheeked thrips, whereas *Amphibolothrips* came from lesser thrips that often lost their wings and became rough-headed. Presumably these last two lines have developed more recently than the others.

As mentioned before, it seems likely that the *Idolothrips* line originated from a generalized ancestor at about the same time the main body of *Phlaeothrips* came into existence. Although the *Idolothrips* ancestor became differentiated because its stylets thickened, it retained many primitive characteristics. Even today the generalized broad pelta, the possession of praepectal plates, the rounded mouth cones, and the presence of well-developed mesopraesternal sclerites still occur in many of the otherwise specialized offsprings. Males of the *Idolothrips* line probably never did develop glandular areas on the abdominal sterna, nor did they ever develop modified lateral setae on abdominal segment IX. In the main, the *Idolothrips* line tended to produce long-headed thrips of large size.

In the evolution of the Phlaeothripidae there seem to have been many rectilinear trends. Except for a few primitive genera, the maxillary stylets tend to become long in all of the lines. Also, in most of the lines the pelta tended to be reduced in size, often the mouth cones became

pointed, and large total size frequently was produced in their ultimate development. Attendant on large body size was the elongation of the intermediate antennal segments and the head. Frequently the praepectus and the mesopraesternum became degenerate or disappeared altogether. Body projections and adornments often developed.

Originally, certain of the structures preadapted the Phlaeothripidae to a new zone and to a new evolutionary flowering. Once well established within that zone and after they had exploited the several major environmental possibilities opened to them, they specialized to more refined niches. In so doing, minor new structures came into being and some of the older structures that first enabled them to become a distinct diverging group were lost. They have become a numerous and highly varied family of insects particularly in the warm temperate and tropical regions of the world.



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- 1937b. Thysanoptera of the Geenton (cont'd). The Florida Entomologist, 20(1):12-15.
- 1937c. Thysanoptera of the Geenton (cont'd). The Florida Entomologist, 22(2):17-21.
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## Plates

PLATE I

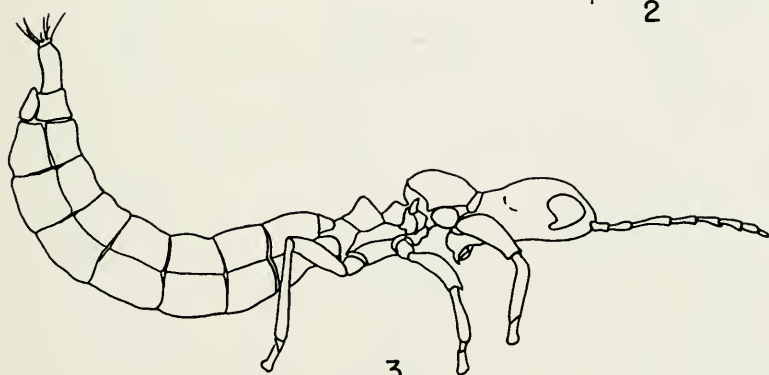
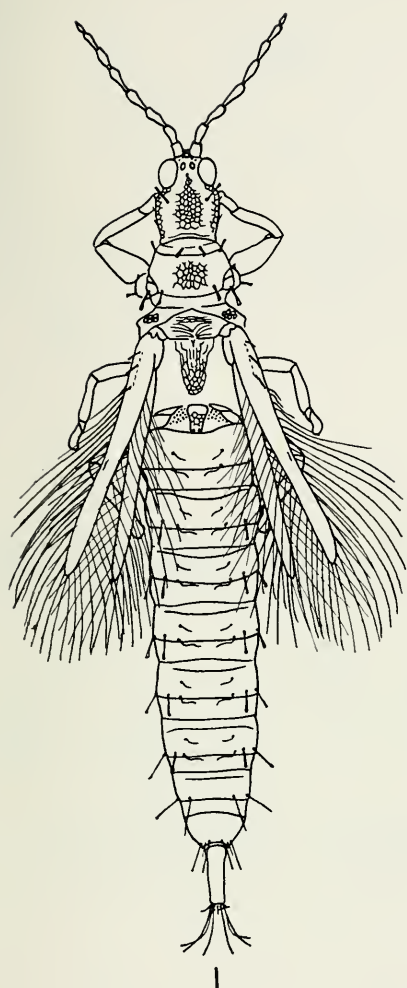
Total views

FIG. 1. *Malachothrips adranes*. Dorsal aspect, body distended.

FIG. 2. *Amphibolothrips (Trachythrips) watsoni*. Dorsal aspect, body distended.

FIG. 3. *Oedaleothrips* species. Lateral aspect.





## PLATE II

Abbreviations: LP—labial palp; MC—mouth cone; MG—maxillary guide; MP—maxillary palp; MPR—maxillary pillar; POS—postocular seta; S—maxillary stylet; SC—sense cone.

FIG. 4. *Preeriella minuta*. Lateral aspect of head.

FIG. 5. Diagrammatic sketch of maxillary stylets and accessory structures.

FIG. 6. *Polyphemothrips junctus*. Ventral aspect of mouth cone.

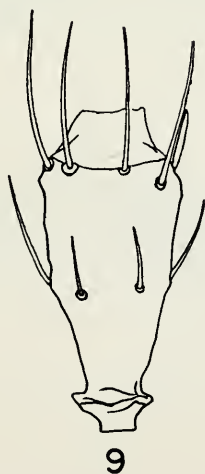
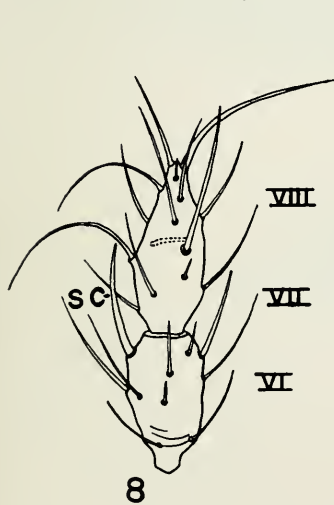
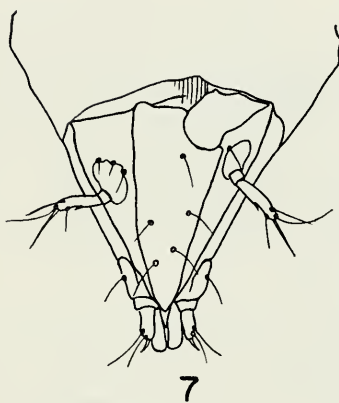
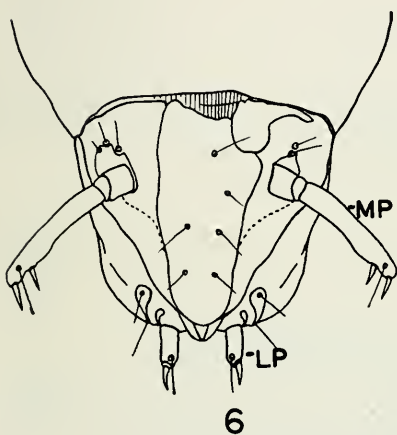
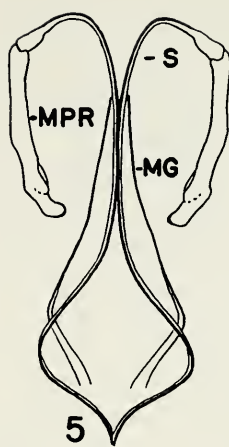
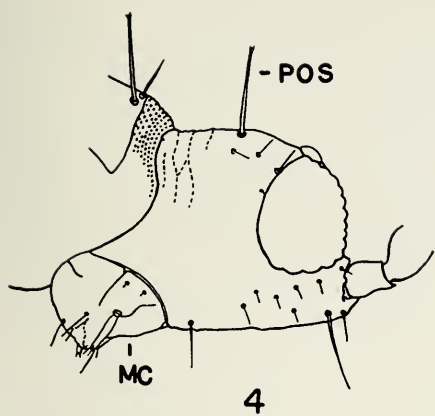
FIG. 7. *Phlaeothrips angusticeps*. Ventral aspect of mouth cone.

FIG. 8. Apex of type of antenna. Dorsal aspect of segment VI and partially fused segments VII and VIII.

FIG. 9. *Agrothrips tenebricosus*. Dorsal aspect of antennal segment III.

FIG. 10. *Stictothrips maculatus*. Dorsal aspect of antennal segment II.

FIG. 11. *Goniathrips denticornis*. Dorsal aspect of antennal segment III.



### PLATE III

Abbreviations: A—abdominal segment; C—coxa; F—femur; FS—fringe setae or cilia; ME—mesosternum; MT—metasternum; P—prothorax; PEL—pelta; SCL—scale of fore wing; TA—tarsus; TI—tibia.

FIG. 12. *Sophiothrips species*. Ventral aspect of thorax.

FIG. 13. Type of fore tarsus.

FIG. 14. *Scopaeothrips unicolor*. Ventral aspect of left fore leg.

FIG. 15. *Stictothrips maculatus*. Enlargement of wing section showing reticulations.

FIG. 16. *Stictothrips maculatus*. Dorsal aspect of right fore wing.

FIG. 17. *Leeuwenia karnyi*. Dorsal aspect of right fore wing.

FIG. 18. *Eupathithrips species*. Seta-bearing cheek wart.

FIG. 19. *Illinothrips rossi*. Spur anterior to mesothoracic spiracle of male.

FIG. 20. *Neurothrips magnafemoralis*. Wing-holding setae.

FIG. 21. *Plectrothrips antennatus*. Orientation of pelta on abdominal segment I.

FIG. 22. *Hydiorhrips species*. Inverted L-shaped prothoracic seta.



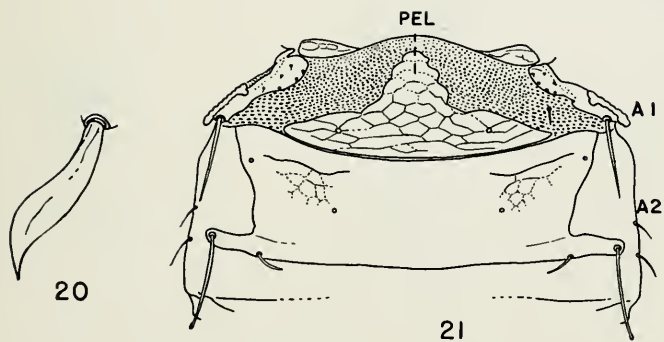
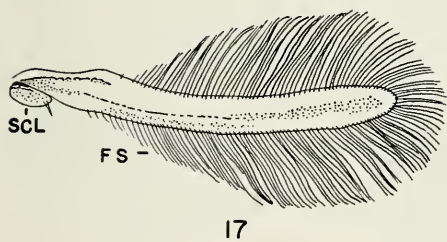
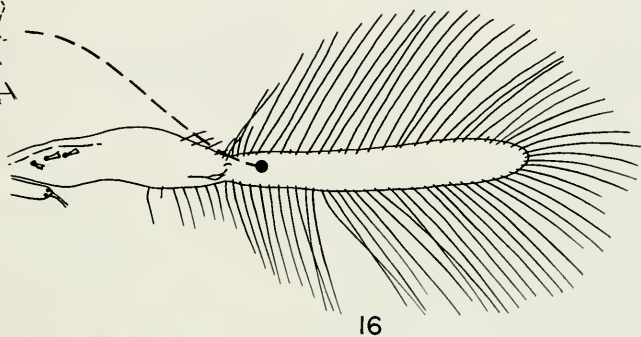
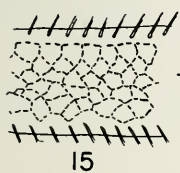
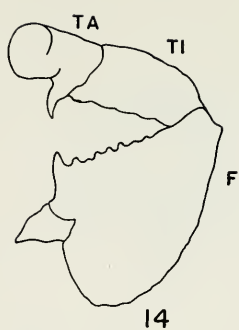
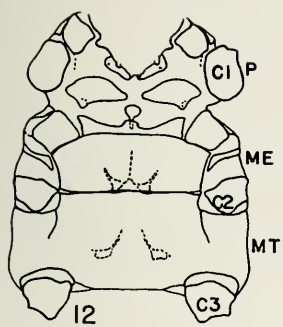


PLATE IV

Abbreviations: BS—probasisternum; MPS—mesopraesternum; PP—praepectus; SP—prospinasternum; WHS—wing-holding seta.

FIG. 23. *Orthothrips boneti*. Median part of prosternum and fore part of mesosternum.

FIG. 24. *Podothrips semiflavus*. Median part of prosternum.

FIG. 25. *Orthothrips bilineatus*. Median part of prosternum.

FIG. 26. *Parallothrips mavromoustakisi*. Ventral aspect of meso- and meta-sternum.

FIG. 27. *Pseudocryptothrips* species. Ventral aspect of mesopraesternum.

FIG. 28. *Sporothrips amplus*. Ventral aspect of mesopraesternum.

FIG. 29. *Illinothrips rossi*. Ventral aspect of mesopraesternum.

FIG. 30. *Elaphrothrips flavipes*. Ventral aspect of mesopraesternum.

FIG. 31. *Idiothrips* (*Strepterothrips*) *conradi*. Right half of abdominal tergum III.

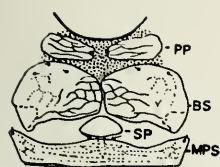
FIG. 32. *Diceratothrips* (*Dichaetothrips*) *claripennis*. Right half of abdominal tergum II.

FIG. 33. *Leeuwenia karnyi*. Right half of abdominal tergum VI.

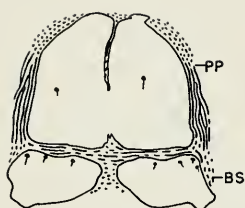
FIG. 34. *Eschatothrips reticulotubus*. Tube.

FIG. 35. *Symphyothrips punctatus*. Tube.

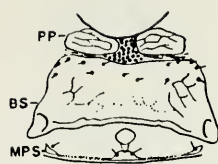
FIG. 36. *Goëtothrips terrestris*. Tube.



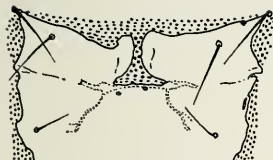
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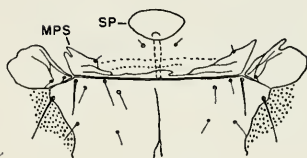
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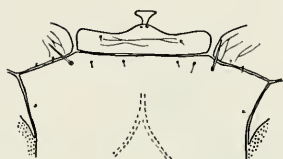
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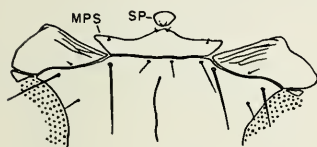
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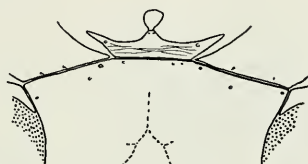
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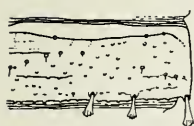
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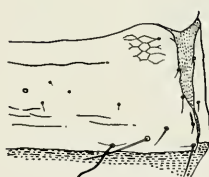
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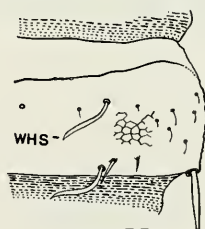
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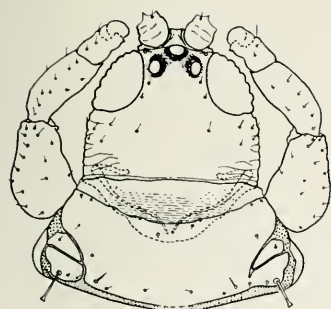


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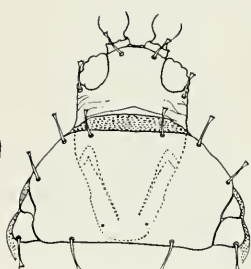
PLATE V

Dorsal aspect of heads and prothoraces

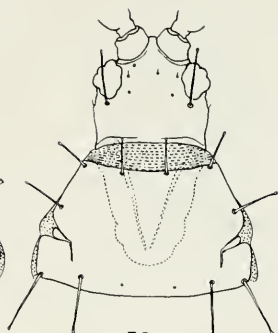
- FIG. 37. *Puebllothrips minutus*.  
FIG. 38. *Sophiothrips bicolor*.  
FIG. 39. *Phthirothrips morgani*.  
FIG. 40. *Williamsiella* species.  
FIG. 41. *Zaxenothrips peculiaris*.  
FIG. 42. *Antillothrips graminatus*.  
FIG. 43. *Plectrothrips antennatus*.  
FIG. 44. *Preeriella minuta*.  
FIG. 45. *Scopaeothrips unicolor*.



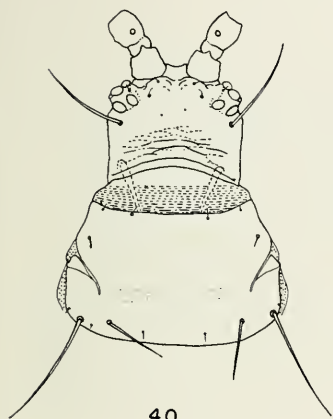
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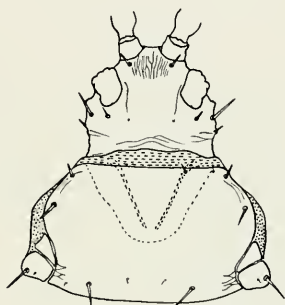
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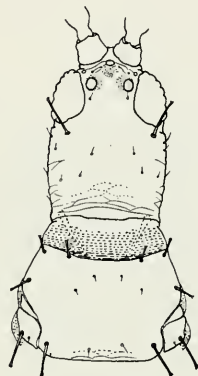
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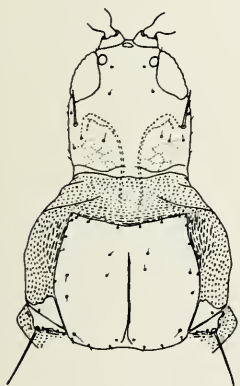
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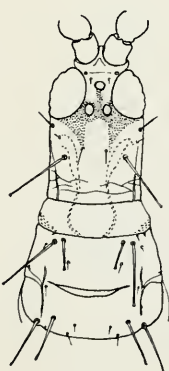
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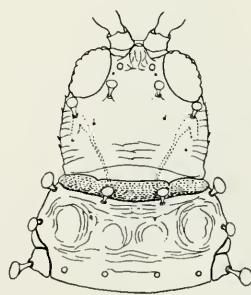
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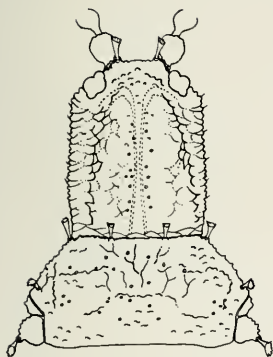
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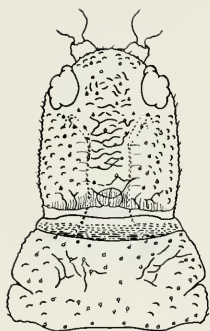
PLATE VI

Dorsal aspect of heads and prothoraces

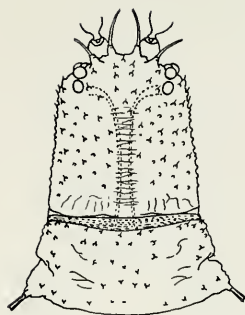
- FIG. 46. *Idiothrips* (*Strepterothrips*) *conradi*. Postocular setae omitted.  
FIG. 47. *Amphibolothrips* (*Trachythrips*) *watsoni*.  
FIG. 48. *Amphibolothrips* (*Stephanothrips*) *bradleyi*.  
FIG. 49. *Amphibolothrips* (*Baenothrips*) *guatemalensis*.  
FIG. 50. *Craniothrips* *urichi*.  
FIG. 51. *Treherniella* *amplipennis*.  
FIG. 52. *Haplothrips* (*Xylaplothrips*) *sonorensis*.  
FIG. 53. *Trybomia* *intermedia*. Postocular and most of the major prothoracic setae omitted.  
FIG. 54. *Haplothrips* (*Leptothrips*) *mali*.



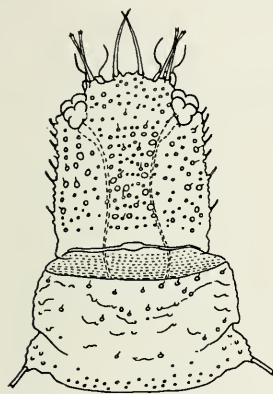
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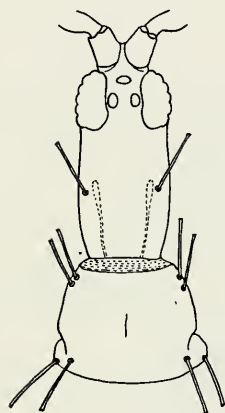
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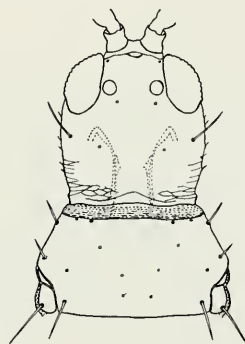
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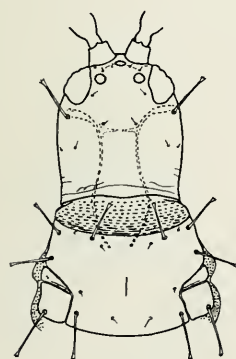
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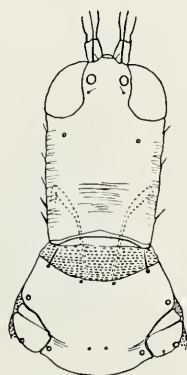
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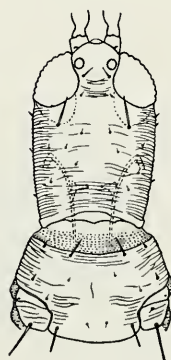
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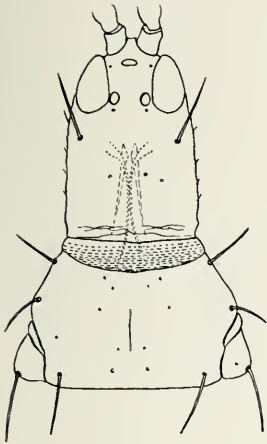


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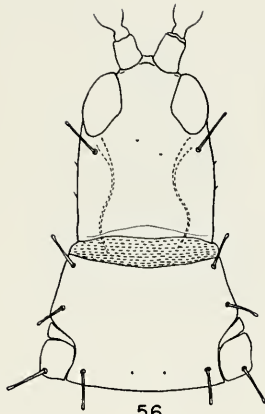
PLATE VII

Dorsal aspect of heads and prothoraces

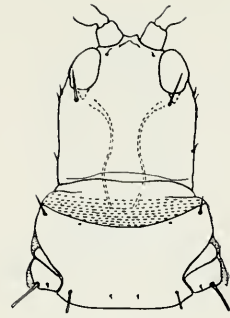
- FIG. 55. *Thorybothrips graminis*.  
FIG. 56. *Agrothrips tenebricosus*.  
FIG. 57. *Adraneothrips desocellatus*.  
FIG. 58. *Adraneothrips vacuus*.  
FIG. 59. *Eurythrips hindsi*.  
FIG. 60. *Eurythrips petteti*.  
FIG. 61. *Erkosothrips floridensis*.  
FIG. 62. *Orthothrips bilineatus*.  
FIG. 63. *Eschatothrips reticulotubus*.



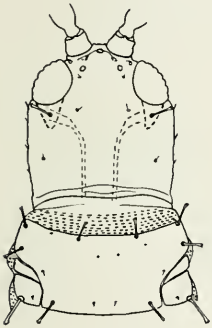
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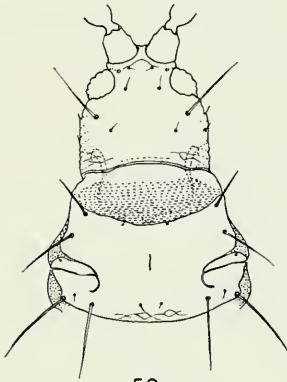
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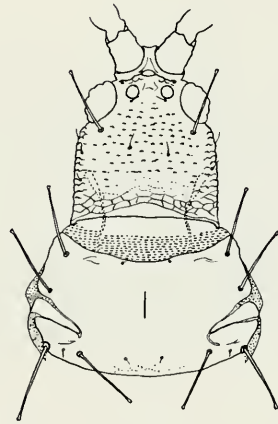
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58



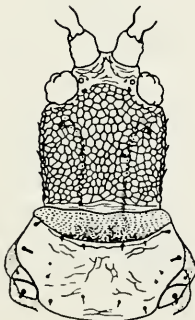
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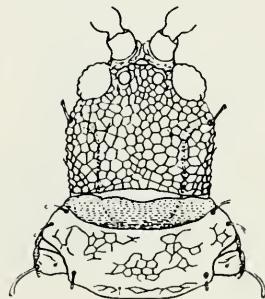
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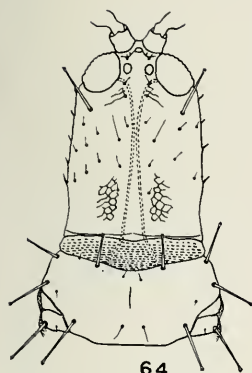
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PLATE VIII

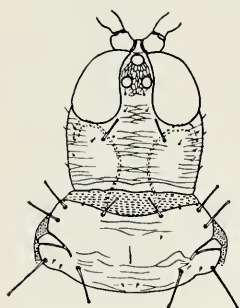
Dorsal aspect of heads and prothoraces

- FIG. 64. *Hoplandrothrips insolens*.  
FIG. 65. *Holopothrips signatus*.  
FIG. 66. *Liothrips citricornis*.  
FIG. 67. *Phlaeothrips angusticeps* (brachypterous).  
FIG. 68. *Phlaeothrips angusticeps* (macropterous).  
FIG. 69. *Phlaeothrips graminis* (brachypterous).  
FIG. 70. *Malacothrips zonatus*.  
FIG. 71. *Malacothrips roycei*.  
FIG. 72. *Macrophthalmothrips pulchellus* (from Hood).

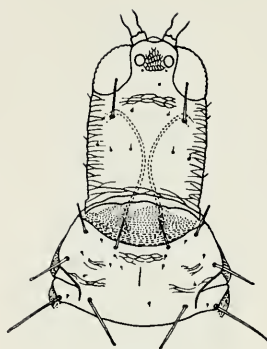




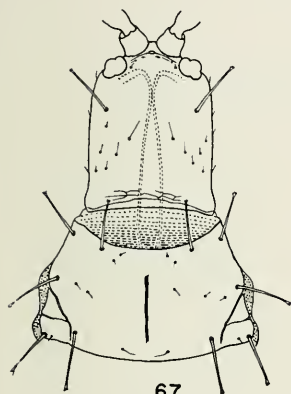
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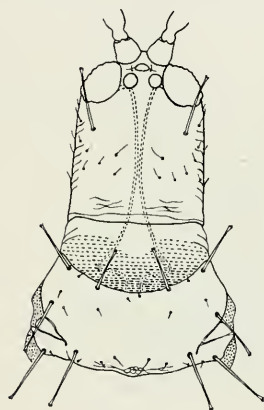
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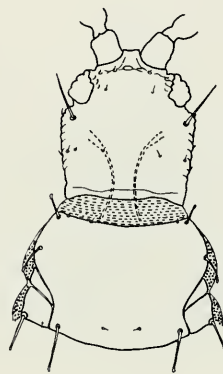
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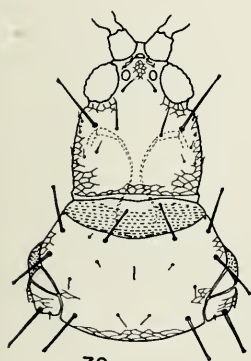
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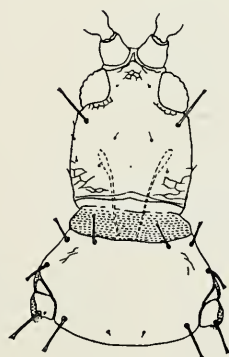
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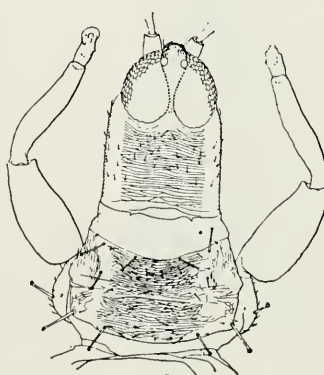
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PLATE IX

Dorsal aspect of heads and prothoraces

- FIG. 73. *Pristothrips* species.
- FIG. 74. *Eupathithrips bagnalli*.
- FIG. 75. *Acanthothrips itzanus*.
- FIG. 76. *Neurothrips magnafemoralis*.
- FIG. 77. *Stictothrips maculatus*.
- FIG. 78. *Acanthothrips nodicornis*.
- FIG. 79. *Polyphemothrips ambitus*.
- FIG. 80. *Polyphemothrips brasiliensis*.
- FIG. 81. *Docessissophothrips richardsi*.

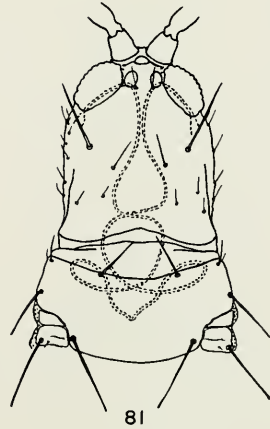
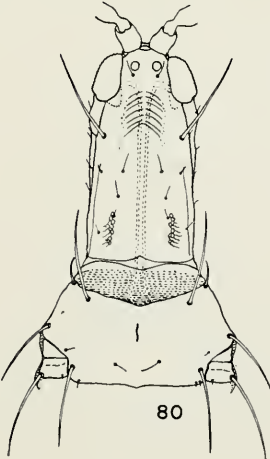
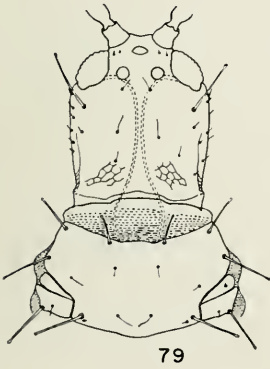
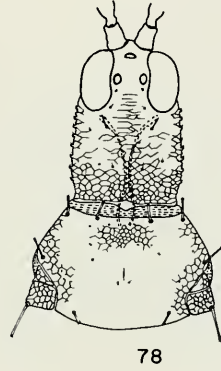
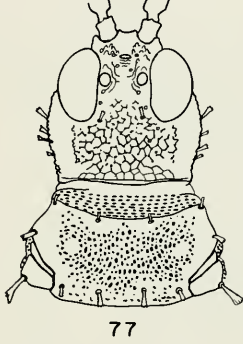
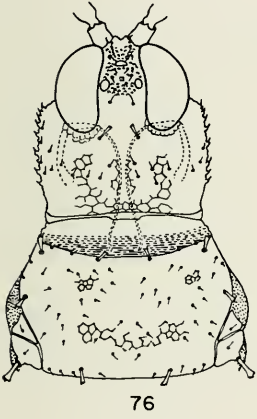
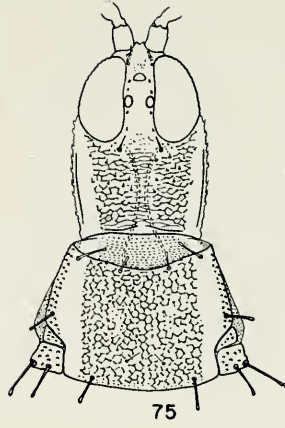
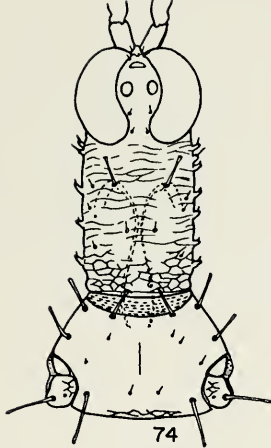
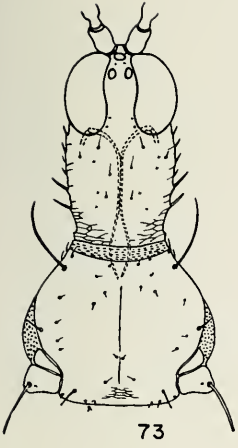
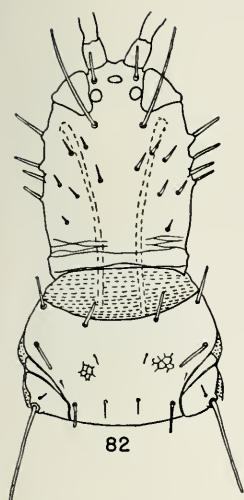


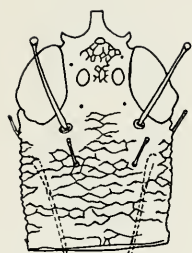
PLATE X

Dorsal aspect of heads and prothoraces

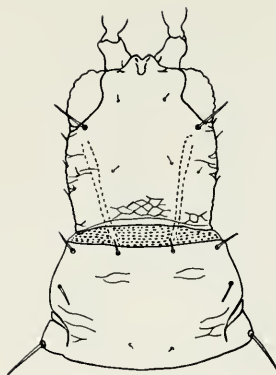
- FIG. 82. *Diceratothrips* (*Endacnothrips*) *horridus*.  
FIG. 83. *Zeugmatothrips hispidus*.  
FIG. 84. *Goëtothrips terrestris*.  
FIG. 85. *Nesothrips ruficauda*.  
FIG. 86. *Nesothrips bicolor*.  
FIG. 87. *Nesothrips diversicolor*.  
FIG. 88. *Cryptothrips carbonarius*.  
FIG. 89. *Diceratothrips* (*Diceratothrips*) species.  
FIG. 90. *Megalothrips spinosus*.



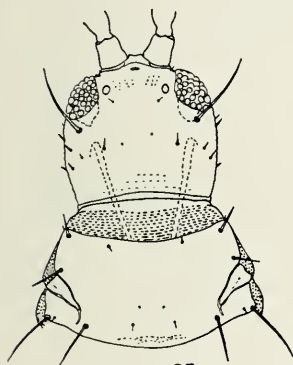
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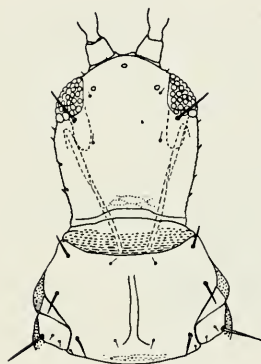
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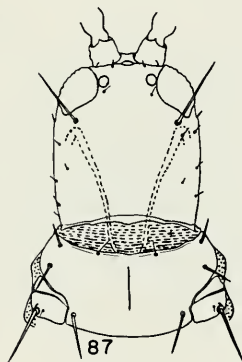
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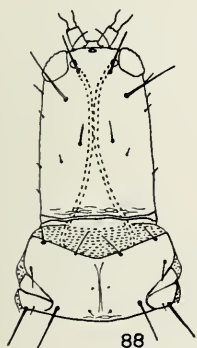
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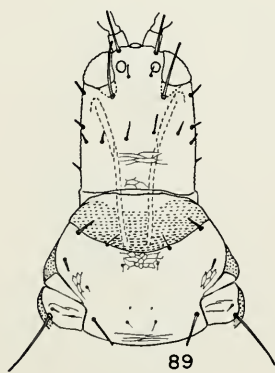
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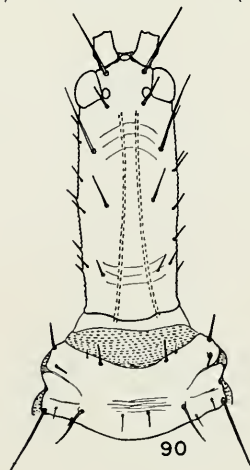
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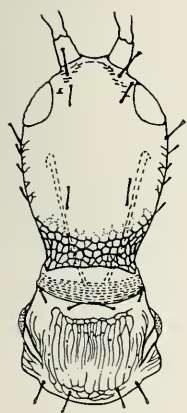
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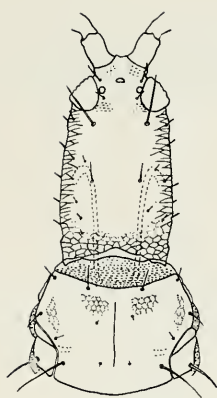
PLATE XI

Dorsal aspect of heads and prothoraces

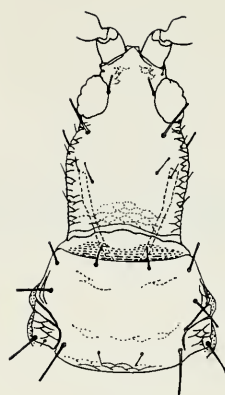
- FIG. 91. *Oedaleothrips* species.
- FIG. 92. *Sporothrips amplus*.
- FIG. 93. *Illinothrips rossi*.
- FIG. 94. *Pseudocryptothrips* species.
- FIG. 95. *Allothrips nubillicauda*.
- FIG. 96. *Priesneriella citricauda*.
- FIG. 97. *Atractothrips bradleyi*.
- FIG. 98. *Hybridothrips oneillae*.
- FIG. 99. *Elaphrothrips coniferarum*.



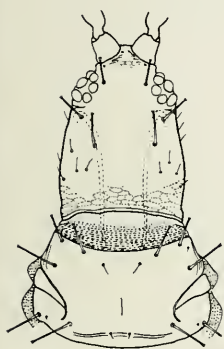
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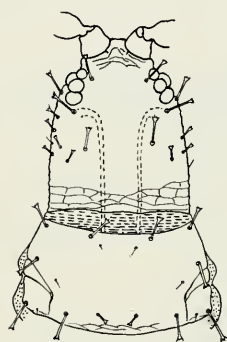
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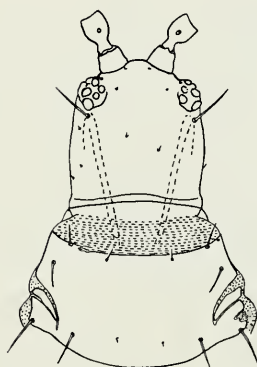
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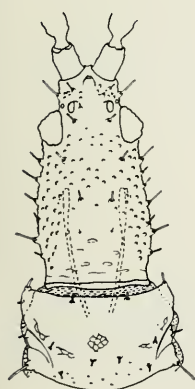
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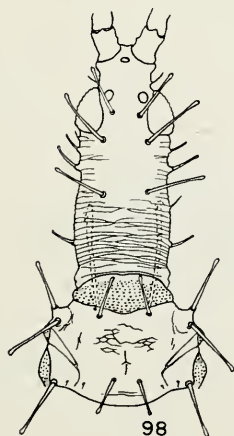
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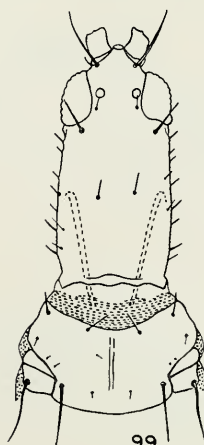
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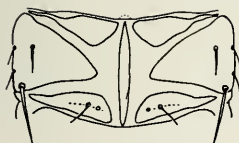
PLATE XII

Types of peltae

- FIG. 100. *Williamsiella* species.  
FIG. 101. *Preeriella minuta*.  
FIG. 102. *Zaxenothrips peculiaris*.  
FIG. 103. *Sophiothrips bicolor* (macropterous).  
FIG. 104. *Sophiothrips bicolor* (apterous).  
FIG. 105. *Scopaeothrips unicolor*.  
FIG. 106. *Idiothrips* (*Strepterothrips*) *floridanus*.  
FIG. 107. *Idiothrips* (*Strepterothrips*) *conradi*.  
FIG. 108. *Amphibolothrips* (*Trachythrips*) *watsoni*.  
FIG. 109. *Lissothrips muscorum*.  
FIG. 110. *Trisclerothrips hurricaneus*.  
FIG. 111. *Phlaeothrips angusticeps*.  
FIG. 112. *Phlaeothrips fungosus* (macropterous).  
FIG. 113. *Phlaeothrips fungosus* (apterous).  
FIG. 114. *Liothrips usitatus*.



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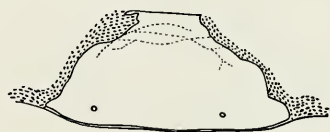
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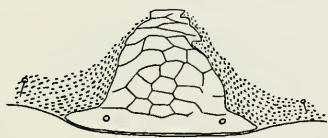
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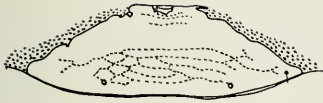
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PLATE XIII

Types of peltae

- FIG. 115. *Lispthrips crassipes* (from Alaska).  
FIG. 116. *Lispthrips crassipes* (from Hungary).  
FIG. 117. *Lispthrips crassipes* (from Russia).  
FIG. 118. *Haplothrips* (*Leptothrips*) *mali*.  
FIG. 119. *Poecilothrips albopictus*.  
FIG. 120. *Gynaikothrips* species.  
FIG. 121. *Macrophthalthothrips* species.  
FIG. 122. *Holopothrips* species.  
FIG. 123. *Hoplandrothrips funebris*.  
FIG. 124. *Metriothrips* species.  
FIG. 125. *Polyphemothrips brasiliensis*.  
FIG. 126. *Eurythrips ampliventralis*.  
FIG. 127. *Eschatothrips barythripoides*.  
FIG. 128. *Eurythrips hindsi*.  
FIG. 129. *Eurythrips petteti*.

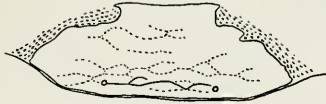




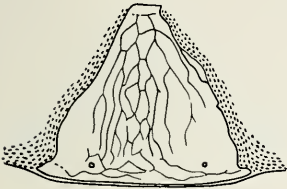
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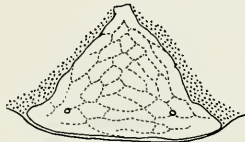
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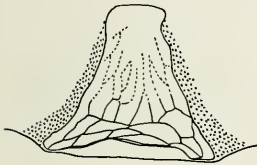
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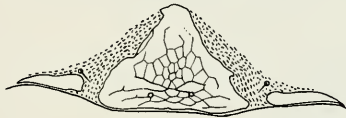
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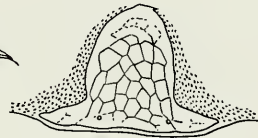
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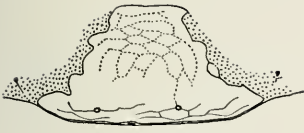


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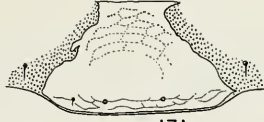
PLATE XIV

Types of peltae

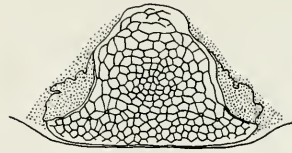
- FIG. 130. *Malacothrips zonatus* (macropterous).  
FIG. 131. *Malacothrips zonatus* (brachypterous).  
FIG. 132. *Acanthothrips coriaceus*.  
FIG. 133. *Acanthothrips albivittatus*.  
FIG. 134. *Sedulothrips tristis*.  
FIG. 135. *Neurothrips magnafemoralis*.  
FIG. 136. *Eupathithrips bagnalli*.  
FIG. 137. *Barythrips* species.  
FIG. 138. *Adraneothrips alternatus*.  
FIG. 139. *Allothrips megacephalus*.  
FIG. 140. *Nesothrips bicolor*.  
FIG. 141. *Sporothrips amplus*.  
FIG. 142. *Megalothrips spinosus*.  
FIG. 143. *Cryptothrips rectangularis*.  
FIG. 144. *Idolothrips marginatus*.



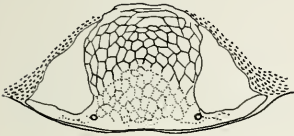
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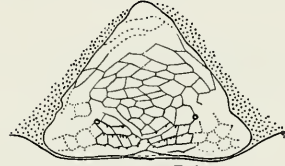
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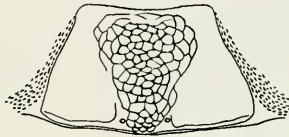
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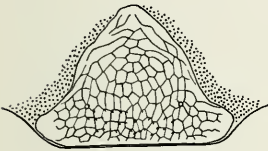
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